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A METHODOLOGY FOR ANALYZING THE APTITUDE CONTENT OF THE NON-PRIOR SERVICE YOUTH AND ENLISTED APPRENTICE POPULATIONS

By

William P. Hutzler
Patricia A. Insley
Betty Lou Bantor

29 May 1985

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This report presents the development of an aptitude cluster concept. Seven aptitude categories, called aptitude clusters, are defined. Their use is demonstrated in an analysis of the qualification of people for military occupations. A methodology for projecting the long-term supply of manpower by aptitude category is also described and demonstrated.

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PREFACE

Management Consulting & Research, Inc. (MCR) has been tasked by the Office of the Assistant Secretary of Defense for Manpower, Installations and Logistics, OASD(MI&L), under contract MDA903-82-C-0400, to:

- develop and implement a methodology for projecting the long-term supply of manpower, by categories of aptitude, in the non-prior service (NPS) youth population;
- design a procedure for determining, very early in the acquisition process, manpower demand over the life cycle of an individual weapon system;
- implement and validate the demand projection methodology by estimating manpower requirements for that weapon system; and
- recommend ways in which to generalize the manpower demand methodology to weapon systems in all four Services.

This technical report addresses the first task above. A methodology developed to project the long-term supply of manpower by aptitude categories is described and demonstrated. Seven aptitude categories, called aptitude clusters, have been developed for this purpose and are defined. Sample formats for displaying aptitude cluster and composite qualification rates in the U.S. non-prior service (NPS) youth population (males and females), and the military population of enlisted apprentice personnel, are also discussed.

The implementation of the MCR manpower supply and demand methodologies will provide the Department of Defense a way to identify probable weapon system manning constraints while systems are still in the earliest stages of their acquisition planning.

The authors would like to acknowledge the continued guidance of W. B. Bergmann and Kimble D. Pendley, both of OASD(MI&L-L&MM), and Lt. Col. Lynton C. Dudley, of OASD(MI&L-MP&FM). W. S. Sellman, OASD(MI&L-AP) provided valuable insight into the interpretation and use of the Aptitude Cluster concept. Elaine Sellman of the Defense Manpower Data Center provided technical and programming support.

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I. INTRODUCTION

In this section, the background and purpose of this study, along with the approach taken in performing this analysis, are discussed. The organization of this technical report is described at the end of this section.

A. BACKGROUND AND PURPOSE

The need to identify the quantity and quality of manpower required for the operation and maintenance of a weapon system has long been a concern of the Department of Defense. More recently, there has been an added emphasis on determining manpower requirements earlier in the weapon system acquisition process, when the knowledge can potentially influence planning processes more effectively.

One possible use of such analysis is the consideration of the impact of new weapon system requirements on the inventory of manpower which may be available to operate and maintain the system when fielded. In order to assess this impact, it is necessary to be able to project the potential supply of available manpower, and to be able to use this estimate to reflect the capabilities the population may have to perform the required occupations.

Management Consulting & Research, Inc. (MCR) was tasked by the Office of the Assistant Secretary of Defense (OASD) for Manpower, Installations and Logistics (MI&L) to address this

problem. A dual-faceted approach was involved, focusing separately on the estimation of the potential supply of manpower, and the early-on projection of the actual requirements for manpower by the weapon system. Four tasks were involved in the initial phase of this study:

- develop and implement a methodology for projecting the long-term supply of manpower, by categories of aptitude, in the non-prior service youth population;
- design a procedure for determining, very early in the acquisition process, manpower demand over the life cycle of an individual weapon system;
- implement and validate the demand projection methodology by estimating manpower requirements for a weapon system; and
- recommend ways in which to generalize the manpower demand methodology to weapon systems in all four Services.

This technical report addresses MCR's accomplishments in the first task. The purpose of this task is threefold:

- to develop a technique for projecting the portion of the civilian population that must be accessed into the military in the next 30 years (for this study, to 2010);
- to develop a technique for considering how the enlisted military population may change over time due to civilian accession, military transitions, and attrition of the enlisted military population over the same time period; and
- to develop a capability for considering the enlisted aptitude qualification criteria of the Services in light of how the civilian and enlisted military populations represent these aptitude qualifications.

The techniques developed in this study are intended to provide an expanded ability within OSD and the Services for considering how current and future aptitude requirements may be represented in the manpower pools potentially available to them.

The ability to consider the aptitude characteristics represented by the manpower requirements of a new system, and the aptitude composition of the current and future enlisted manpower supply is a critical necessity for manpower planners at all levels. This requirement, to consider aptitudes in terms of manpower supply and demand, is clearly stated in MIL-STD-1388-1A, Logistic Support Analysis (30 April 1982). The analysis conducted in this task responds to this need.

B. APPROACH

MCR's approach in performing this task involved developing a model for estimating the future civilian non-prior service (NPS) and the military enlisted apprentice populations, based on the total projected youth populations; and developing a structure for arraying all four Service aptitude composite sets in a single set of seven categories, called aptitude clusters. MCR demonstrated the population projection model by developing a set of estimates of the total number of 17 to 21 year olds between 1982 and 2010. Examples of these estimates for aptitude composites and clusters are included in an appendix of this report. The overall population of 17 to 21 year olds is of interest since this age group is generally the population from which a majority of apprentice enlisted military personnel are recruited.

The approach taken in developing the methodology for estimating the NPS youth and enlisted apprentice populations by aptitude, involved:

- identifying a population base from which to develop estimates to 2010;

- developing a scheme for defining aptitudes which is compatible with current (1982) Service aptitude classification systems and yet is appropriate for use across all four Services; and
- developing a model which allows for calculation of both the NPS youth population and enlisted apprentices, in terms of their total annual estimated population, by aptitude category and age.

Bureau of the Census estimates of selected age groups (16 to 21 year olds) were used as the initial population base for demonstrating the long-term population projection methodology. The population estimates were developed using a set of specialized rates representing various transitional characteristics affecting the NPS youth and enlisted apprentice populations. The values for these rates were constrained for the purposes of this demonstration. Actual calculation of population projections for these groups would use rates reflective of the dynamic trends influencing the potential availability of NPS youth and enlisted apprentices in the long term.

Seven aptitude categories, called aptitude clusters, were developed by MCR based on analysis of the Services' own aptitude composites. These composites are designed by each Service to represent aptitudes required to successfully complete training for particular occupations within the Service. There were 26 aptitude composites used by the Services at the time of this analysis. These composites are defined in terms of minimum scores required on combinations of Armed Services Vocational Aptitude Battery (ASVAB) subtests. The MCR aptitude clusters are based on analysis of the construction of the Service composites. Applying the MCR definition of aptitude clusters to the data

bases, aptitude cluster and composite qualification rates were developed. These qualification rates for the NPS and enlisted apprentice populations have been used as inputs to the MCR population projection model.

MCR developed the Projection of Manpower Supply and Aptitudes (PROMANSA) model to project the annual populations of NPS youth and enlisted apprentices. Using Bureau of the Census population estimates for the selected age groups as initial input data, the model applies a set of fixed transition rates to produce an estimate of the annual military and NPS youth populations to 2010. The military population is represented in three parts:

- the number of accessions,
- the number of enlisted apprentices, and
- the number of enlisted journeymen/supervisors.

Sample aptitude cluster and composite qualification rates are applied to the enlisted apprentice and NPS youth population portion of the estimates, in order to demonstrate that the aptitude content of those two populations can be projected.

Sample aptitude composite and cluster qualification rates were developed based on analysis of data bases representing the civilian youth and military accession populations: the Profile of American Youth study, representing NPS youth; and the FY81 and FY82 military accession master data files, representing enlisted apprentices. Qualification rates for these two groups were developed by age and applied to demonstrate that refined estimates of the long-term population could be developed. Since the

major intent of this portion of the task was to demonstrate the capability to develop these estimates, no attempt was made to approximate the complete set of factors influencing the accession and retention of the populations. The transition rates used in this demonstration are intended to indicate some of these factors. The PROMANSA model was designed to be easily modified to accept varying annual rates for any number of factors in addition to the ones used in this demonstration.

The data bases were used to obtain sample qualification rates related to selected demographic characteristics, (i.e., age, race, sex and census division). Examples of types of results which can be developed by this analysis of the aptitude composite and cluster qualification rates are discussed in this technical report.

C. ORGANIZATION OF THIS TECHNICAL REPORT

Following this introduction, there are three major sections and a set of appendices. In Section II, the model MCR developed to calculate the aptitudes of the manpower supply to 2010 is discussed. The Projection of Manpower Supply and Aptitudes (PROMANSA) Model is described in terms of its structure and input data. In Section III, the aptitude clusters developed by MCR and the Service-specific aptitude composites are described. In Section IV, examples of the aptitude distribution of the projected NPS youth population and enlisted apprentices are examined in terms of aptitude composite- and aptitude cluster-specific

qualification rates. Section IV also contains a discussion of the implications of this and related work. Following these sections are a set of appendices which provide additional technical information and document the references used in this study.

II. PROJECTION OF MANPOWER SUPPLY AND APTITUDES MODEL

MCR's first task in this study was to develop and demonstrate a methodology for projecting the long-term supply of the non-prior service (NPS) youth population and analyzing the projected aptitudes of this population. The purpose of this requirement was to demonstrate that aptitude and population characteristics of the NPS youth population to 2010 could be projected. This is an important time frame for DoD analysts since weapon systems being conceptualized now will be fielded during this period.

The size of the civilian youth population reached a peak in 1979. (Hereafter, the term "youth population" refers to those individuals within the 17 to 21 year old age bracket.) Long-term Bureau of the Census projections, however, indicate significant declines in the size of this group beginning in 1982. This age group is of interest since the NPS portion comprises the primary target population from which enlisted apprentices are recruited. These projections will be discussed in detail as input data to a model, developed by MCR, called Projection of Manpower Supply and Aptitudes (PROMANSA).

This section of the report discusses the structure of the PROMANSA model and the data needed to support the model.

A. STRUCTURE OF THE PROMANSA MODEL

In developing a methodology for projecting the aptitudes of the out-year NPS youth population, MCR identified several desirable characteristics. The model should:

- be automated to allow for ease of calculation and adjustment of input data;
- be structured to allow for the arraying of the projected NPS youth in terms of their potential relationship to the military enlisted apprentice pool;
- be flexible to allow for the incorporation of a variety of transition and projection factor values, with annual values for each factor if necessary;
- recognize the need to consider the relationships between the apprentice manpower and journeymen/supervisor manpower; and
- incorporate a qualitative and quantitative definition of the aptitude categories.

The model MCR has developed is composed of three major parts, illustrated in Exhibit II-1:

- the NPS Youth Population Calculation, in which the initial estimate of the number of NPS 17 to 21 year olds between 1982 and 2010 is calculated;
- the Force Structure Model, in which the number of enlisted accessions, apprentices and journeymen/supervisors are calculated for the years between 1982 and 2010; and
- the Aptitude Cluster Qualification Analysis, in which the distribution of aptitudes among the projected NPS youth population and the enlisted apprentices are analyzed and projections developed.

The first part of the model involves the calculation the basic NPS youth population which provides the basic input to the Force Structure Model portion of the calculation. For the purpose of this demonstration, only two major inputs to the NPS Youth Population Calculation have been used:

- the Bureau of the Census estimates of the total number of 16 year olds to 2010, and the number of NPS youth in 1982, ages 17 to 21; and
- 1982 military accession rates for 17 to 21 year olds.

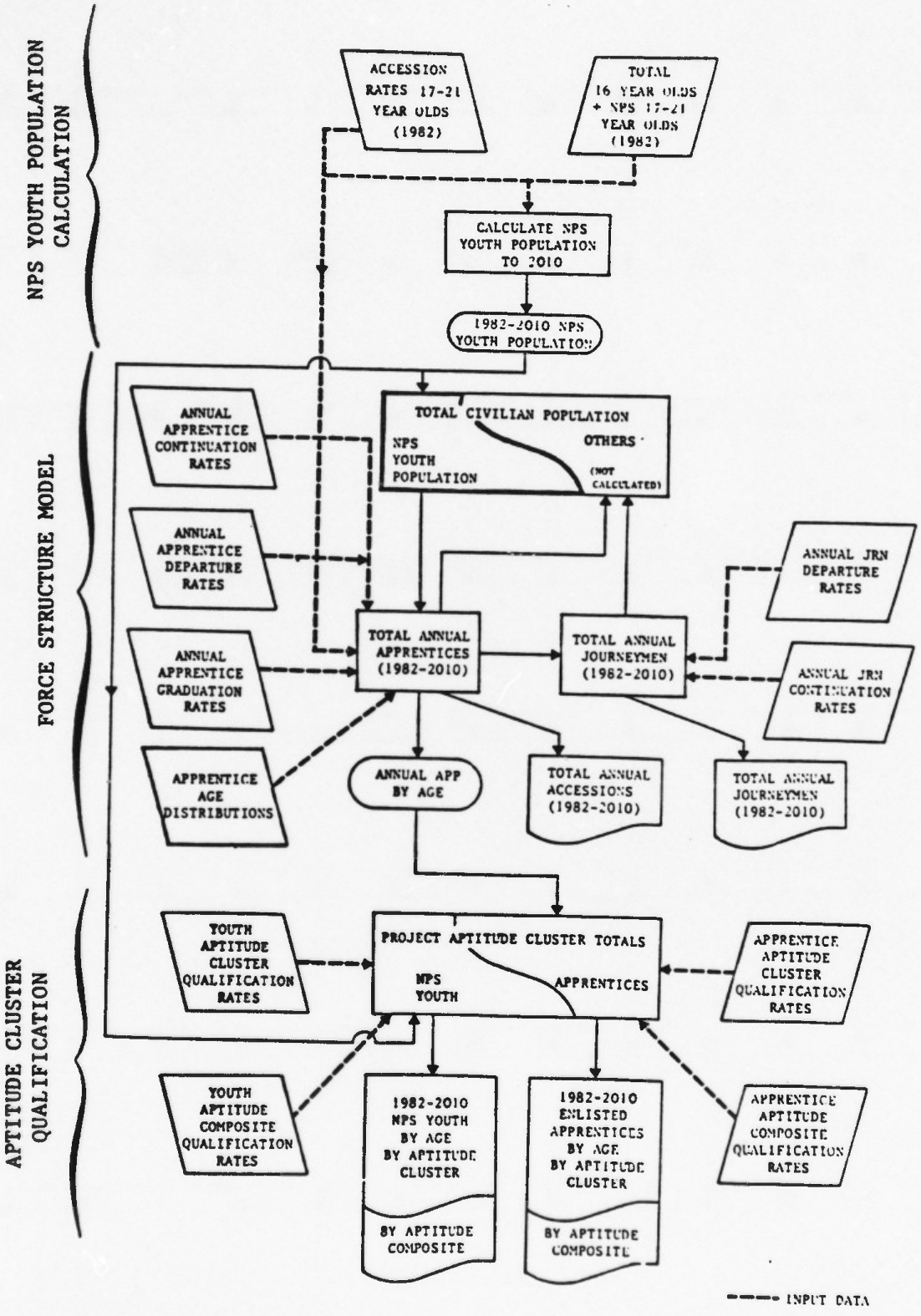

Exhibit II-1. THE PROJECTION OF MANPOWER SUPPLY AND APTITUDES (PROMANSA) MODEL

These data have been used to develop an estimate of the potential pool of civilian manpower available for recruitment from 1982 to 2010. Actual accession analysis shows that in reality this civilian pool would be influenced by a more varied set of factors and can be expected to probably be larger due to factors such as increased immigration and changes in birth and mortality rates. The data used in these and the subsequent portions of the PROMANSA calculations are discussed in more detail in the following subsection. Suffice it to say that the calculations conducted in this demonstration are merely representative of the types of calculations which should be performed. The product of this first part of the PROMANSA calculation is an estimate of the 1982 to 2010 NPS youth populations.

Exhibit II-2 shows the basic structure of the second part of the PROMANSA model. The estimate of the pool of NPS youth for the period from 1982 to 2010, calculated in the first part of the model, provides the basis for the subsequent estimation of annual enlisted accessions, apprentices and journeymen/supervisors. The remainder of the civilian population, identified as "Others," represents that portion of the population which either do not serve or are former apprentices and/or journeymen and have left the military. This portion of the civilian population is <u>not</u> explicitly treated in the model.

In the Force Structure Model, an overall estimate of the manpower projected to be in the Force Structure is developed. This part of PROMANSA is a Markov transition model which "time-steps" groups of individuals on an annual basis, using fixed

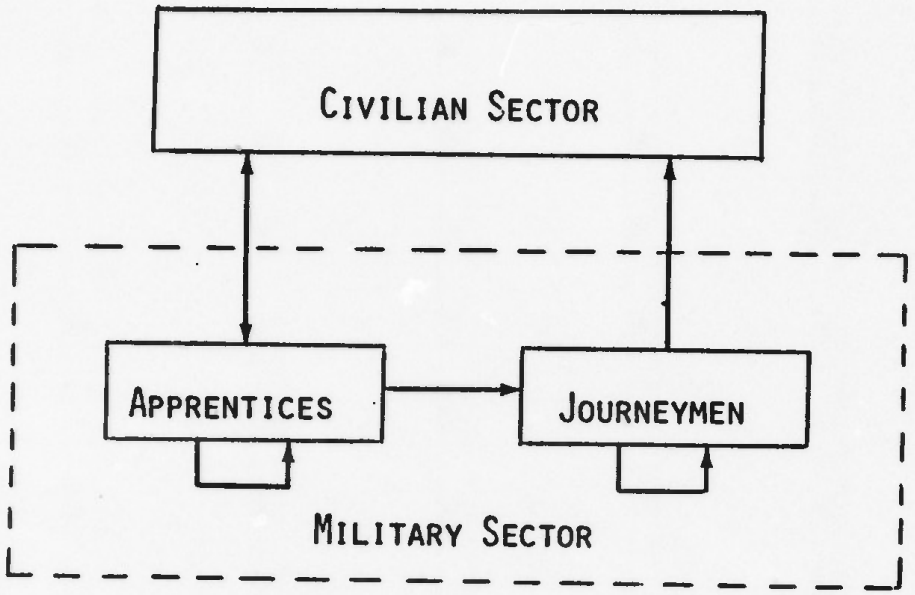

Exhibit II-2. PROMANSA FORCE STRUCTURE MODEL

transition rates. Using these rates (in this demonstration calculated from a sampling of historical data), annual accessions (i.e., the number of enlisted personnel entering any of the Services) are calculated for each year of the period. Each year a portion of those apprentices transition to journeymen, leave the Service and return to the civilian pool, or continue on as apprentices. Standard flow rates are used to calculate each of these movements. Similar options are available to the journeymen, with a portion of the total number of journeymen annually continuing as journeymen or returning to the civilian pool. Exhibit II-2 illustrates these relationships.

In order to simplify these calculations, MCR has implanted certain assumptions in the PROMANSA model. These are briefly outlined below:

- Rates used in this demonstration to estimate the future populations have been limited in number to a few representative rates; limited in variety to a single value used for each annual calculation (versus being varied annually); and based on a limited sampling (i.e., the 1981 and 1982 military accessions and the Profile of American Youth study).

- Alternative options such as direct entry into the journeyman/supervisor category and recruitment of apprentices older than 21 years old have not been incorporated in these calculations, in order to simplify the demonstration.

- Medical discharges and death of military personnel are considered in the model as part of the return to the civilian pool, in that the individual is no longer an apprentice or journeyman.

- Apprentices and journeymen/supervisors are categorically defined in terms of years of service, regardless of individual Service conventions. The term apprentice is applied to enlisted personnel with up to four years of service; the term journeyman/supervisor applied to all enlisted personnel with five or more years of service.

The product of the second part of the PROMANSA model is a calculation of the total annual number of enlisted accessions, apprentices and journeymen to 2010. The annual apprentice totals are necessary for the remaining portion of the analysis; however, the accession and journeymen calculations are not used further.

In the third part of the model, the Aptitude Cluster Qualification, the annual NPS youth population (calculated in the first part of the model) and the enlisted apprentice population (estimated in the second part) are analyzed to determine the distribution of selected aptitudes in the two groups. This analysis is performed using aptitude cluster and composite qualification rates individually applied to each population. These rates represent the rates at which civilian and military personnel have qualified in the various aptitude clusters and composites. MCR has developed a set of seven aptitude clusters based on analysis of the Services' aptitude composites. These clusters and the related composites are defined in terms of minimum scores required on various combinations of ASVAB subtests. The Services use their composites in classifying recruits for the various occupations within the Service. Based on analysis of the commonality of the combination of the subtests defining these composites, seven aptitude clusters were defined. These clusters reflect the more aggregate characteristics shared by the different Services and are non-Service specific. The development and definitions of the aptitude clusters are discussed in detail in Section III of this report.

Qualification rates have been calculated using the definitions of aptitude clusters developed by MCR, and the Service-specific aptitude composites. Using these two sets of qualification rates, the model calculates, for each year of the projection period, the number of NPS youth qualifying in each aptitude cluster and service composite, by age. Using additional information on the age distribution of apprentices, a similar calculation is developed for the enlisted apprentices.

Ultimately, six products are developed by the PROMANSA model:

- the total number of NPS youth between the ages of 17 and 21, for each year between 1982 and 2010;
- the total number of enlisted accessions, apprentices and journeymen/supervisors between 1982 and 2010;
- the total number of NPS youth in each of the seven aptitude clusters, by age, between 1982 and 2010;
- the total number of enlisted apprentices in each aptitude cluster, by age, between 1982 and 2010;
- the total number of NPS youth in each of the 26 Service composites, by age, between 1982 and 2010.

A more detailed discussion of the mechanics and the actual computer code of the PROMANSA model are contained in Appendix A. Examples of the type of data generated by the PROMANSA model are given in Appendix B.

Having described the basic structure of the model, the data used to calculate these estimates are discussed next.

B. DATA USED IN THE PROMANSA MODEL

The PROMANSA model has been demonstrated using four specific types of data:

- Bureau of the Census estimates of the population of 16 year olds to 2010, and the number of NPS 17 to 21 year olds in 1982;

- calculated transition rates, specifically:
  - age-specific military accession rates,
  - apprentice continuation rates,
  - apprentice departure rates from the military,
  - apprentice graduation rates to journeymen,
  - journeymen continuation rates, and
  - journeymen departure rates from the military;
- apprentice age distributions; and
- qualification rates for the aptitude clusters and aptitude composites for the NPS youth population and enlisted apprentices.

The projections developed for this study have been developed using constant transition rates, age distributions and aptitude qualification rates. These data have been developed from a variety of sources, based on the best data available at the time of this study. However, being aware that new and more refined data are constantly being developed, MCR has designed the PROMANSA model to be easily modified to accept more detailed, annually variable data and additional data types, if necessary. The four types of input data are briefly described below.

1. Bureau of the Census Population Estimates

The initial calculation of the total number of NPS youth (17 to 21 year olds) for each year between 1982 and 2010 has been, for this demonstration, based on two inputs:

- the estimated total number of 16 year olds between 1982 and 2010 (who become the next year's 17 year olds), and the number of NPS youth, by age (17 to 21 year olds), for 1982; and
- age-specific military accession rates for 17 to 21 year olds.

The Bureau of the Census, in addition to maintaining historical data bases of the U.S. population, develops several series of population projections, presented in terms of size and composition. Historically, the size of the U.S. population has exhibited fluctuations, with population upswings generally occurring after major events such as military conflicts, or concurrently with times of economic prosperity. In the last 40 years, there have been two significant population "booms": after the Second World War and after the Korean War. Recent data indicates, however, that a decline in the birth rate began in 1973. Births per 1000 population declined from 18.4 in 1970 to 14.8 in 1976, increased again slightly in 1977 to 15.4, and remained relatively stable for the remainder of the decade.

In addition to using historical data, the Bureau of the Census population projections are also based on projections of various other rates, specifically:

- fertility rate,
- mortality rates,
- levels of immigration, and
- migration patterns.

Three basic series of population projections are prepared using various values for these rates. Some of these rate values are varied across series, while others are held constant. In each series, the fertility rates are different: Series I projections assume 2.7 to be representative of the average number of births during the lifetime of a female; Series II and III

assume 2.1 and 1.7 births, respectively. According to the Bureau of the Census, current trends in fertility indicate that Series II is the projection most likely to be realized.

The Census assumptions regarding future mortality have recently been revised to account for the recent decline in age-specific death rates among middle-aged and older adults. According to data provided by the Office of the Actuary, Social Security Administration, between 1976 and 2050, average life expectancy at birth is assumed to increase from 69.1 to 71.8 years for males and from 77.0 to 81.0 years for females. These are used for all of the Census projection series.

The level of net immigration assumed by the Bureau of the Census is a constant 400,000 persons per year. This figure includes only the recorded level of legal immigration. Illegal immigrants and emigrants are excluded from the count due to a lack of reliable data. Changes in immigration laws could significantly influence this rate, and, therefore the total population projection.

Finally, concerning migration patterns, Series IIB assumes a continuation from 1975 through 2000 of the civilian, non-college interstate migration patterns observed from 1970 to 1975. According to the Bureau of the Census Population Projections Branch, Series IIB statistics are expected to be the most accurate, given the current trend illustrated in the 1980 Census.

Based on these assumptions, the Bureau of the Census has developed estimates of the population to 2010. The Series IIB projection has been used in this study as the basis for developing the input data for the NPS youth population. The

number of 17 to 21 year old NPS youths has, and is expected to continue to fluctuate drastically between 1960 and 2010. From the peak reached in the 1976-1980 period, a long decline is projected, with a population trough expected in 1994. Despite the projected population increase after the trough, it is not expected that the youth population will reach the size found in the late 1970s before 2010.

The projected number of 16 year olds from 1982 to 2010, and the number of NPS 17 to 21 year olds in 1982, are used as one of the initial inputs of the PROMANSA model. The number of NPS 17 to 21 year olds to 2010 is calculated based on the application of individual accession rates for 17, 18, 19, 20 and 21 year olds. Those rates were developed from analysis of historical accession rates, and were used here for demonstration purposes only. Exhibit II-3 indicates a projection of the size of the NPS youth population by age to 2010.

2. Calculated Transition Rates

In applying the various transition rates, constant values for each rate have been used throughout the model's projection period. Thus, for each year from 1982 to 2010, the same accession rate is applied to 17 year olds throughout the calculation. While different rates have been developed for each age group, none of these age-specific accession rates are varied throughout the time period due to lack of data on which to calculate future rates. These accession rates are used in two places in the PROMANSA model:

- to calculate the NPS Youth Population, in the first part; and

YEAR	16	17	18	19	20	21
1982	3661	3888	4087	4185	4326	4277
1983	3561	3661	3867	4009	4131	4294
1984	3480	3561	3642	3794	3958	4100
1985	3526	3480	3542	3572	3745	3928
1986	3611	3526	3462	3475	3526	3717
1987	3691	3611	3507	3396	3430	3500
1988	3386	2691	3592	3441	3352	3404
1989	3202	3386	3671	3524	3396	3327
1990	3129	3202	3368	3602	3478	3371
1991	3207	3129	3185	3304	3555	3452
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1993	3222	3160	3190	3053	3084	3237
1994	3318	3222	3143	3129	3014	3061
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1996	3609	3450	3300	3144	3044	3066
1997	3763	3609	3432	3238	3103	3021
1998	3866	3763	3590	3367	3196	3080
1999	3931	3866	3743	3522	3323	3172
2000	3977	3931	3846	3672	3476	3298
2001	3989	3977	3910	3772	3625	3450
2002	4001	3989	3956	3836	3724	3597
2003	4013	4001	3968	3881	3786	3696
2004	4025	4013	3980	3892	3831	3758
2005	4037	4025	3992	3904	3842	3802
2006	4002	4037	4004	3916	3854	3813
2007	3966	4002	4016	3928	3865	3825
2008	3930	3966	3981	3939	3877	3836
2009	3895	3930	3945	3905	3888	3848
2010	3860	3895	3909	3870	3855	3859

Note: Data is in thousands

Exhibit II-3. AGE DISTRIBUTION OF PROJECTED POPULATION OF NPS YOUTH IN THE UNITED STATES: 1982 to 2010

- to calculate the number of accessions annually entering the enlisted apprentice pool.

The other flow rates used in the force structure portion of the model are used in a manner similar to the accession rates. Using historical continuation rate data for the period FY72 to FY80, supplied by the Defense Manpower Data Center (DMDC), MCR developed values for the remaining force structure flow rates:

- apprentice continuation rates,
- apprentice departure rates,
- apprentice graduation rates,
- journeymen continution rates, and
- journeymen departure rates.

Single values were developed for each of these factors and applied as constants throughout the calculation. The values were based on analysis of Service-specific and DoD-wide continuation rate data.

3. Apprentice Age Distributions

In addition to providing continuation rate data, DMDC also provided a breakout of the FY82 apprentice group age distribution. This information was used to develop the apprentice age distribution values, which, in turn, are used to calculate the annual number of apprentices by age. As can be seen in the flow diagram of the PROMANSA Model (Exhibit II-1), the apprentice age distribution data are inputs to the aptitude cluster qualification analysis portion of the model.

Given the above accession, continuation, graduation and departure rates, three lists are developed to describe the projected manpower in the force structure from 1982 to 2010:

- the annual number of accessions,
- the annual number of apprentices, and
- the annual number of journeymen/supervisors.

4. Aptitude Cluster and Composite Qualification Rates

The aptitude cluster qualification projection uses two types of data:

- annual population estimates by age of the NPS youth population and the enlisted apprentices, and
- aptitude cluster and aptitude composite qualification rates for the NPS youth and enlisted apprentices.

The first data are developed in the preceeding sections of the model. The second data were developed externally with the assistance of DMDC. Using the definitions of the seven aptitude clusters developed by MCR as well as the Services' definitions of their aptitude composites, data bases representing the civilian NPS youth population and the military enlisted apprentice pool were analyzed to determine the number of individuals qualifying in each cluster and composite. In selecting the data bases, it was necessary to have populations which had taken the Armed Services Vocational Aptitude Battery (ASVAB), forms 8, 9 and 10. The combination of subtests used in this version of the ASVAB is the basis of the MCR aptitude cluster definitions.

In exercising the model, the data base used to represent the NPS civilian population of 17 to 21 year olds was that developed from the Profile of American Youth study, conducted in 1980.[1/] A national sample of 12,000 American youth, weighted to represent selected ages, males and females, races and census regions, was given the ASVAB. Detailed information on this population was included in the associated data base, including selected demographic data.

Two data bases were used to investigate the aptitude distribution of military enlisted accessions: the FY81 and FY82 military accession master data files maintained by DMDC. The aptitude cluster and composite definitions were applied to both accession files, with very similar results. For this reason, only the FY82 accession analysis is discussed in subsequent sections of this report.

In the Aptitude Cluster Qualification part of the model, the annual population estimates and the cluster and composite qualification rates can be combined to develop projections of the number of NPS youth qualifying in each aptitude cluster and composite by age and year. All of the sample rates used in the PROMANSA model calculations in this study are included in the computer code listing in Appendix A.

The next section of this report contains a discussion of the aptitude cluster concept.

1/ Department of Defense, Profile of American Youth, March 1982.

III. APTITUDE CLASSIFICATION OF MILITARY PERSONNEL

The military Services have a basic need to evaluate the acceptability of persons entering the Service, regardless of whether entrance is voluntary or not. It is necessary to determine if individuals are medically and morally "fit," as well as capable of being trained and having sufficient orientation to perform any of the required jobs the Service has identified. The acceptability of an applicant is determined through a variety of measurements, some of which are common to all of the Services and some of which are Service-unique.

In this section, we present a brief review of military aptitude testing, a description of the Services' aptitude classification schemes, and a description of the aptitude clusters prepared by MCR.

A. REVIEW OF MILITARY APTITUDE TESTING

Modern military applicant acceptance testing dates from World War II. Evaluation of trainability and job performance capability has evolved over this period of time; however, the basic need to ascertain whether an applicant can succeed in being trained and can potentially perform any of the required jobs has not changed. Exhibit III-1 summarizes the development of modern aptitude testing.

Trainability is generally determined through a combination of attained education and the results of a standardized test. The Armed Forces Qualification Test (AFQT) has been used since

Date	Evaluation of Applicant: Trainability	Evaluation of Applicant: Job Classification	Evaluation of Applicant: Test
1940-1942	• Fourth Grade Education • Basic Literacy test	• Army General Classification Test (AGCT) - After Service Entry.	• Vocabulary, Arithmetic Reasoning, Spatial Ability; Mechanical and clerical tests subsequently added.
1943-1945	• Minimal Literacy Requirement dropped	• AGCT - Also used by Army for enlistment screening	
1950	• Armed Forces Qualification Test (AFQT) - modeled after the AGCT		
1973-1975	• Common AFQT replaced by Service-specific test batteries		
1976	• Reinstatement of common AFQT; calculated from selected ASVAB subtests	• Introduction of Armed Services Vocational Aptitude Battery (ASVAB) forms 6 and 7	See Exhibit III-2 for specific subtests.
1980		• ASVAB forms 8, 9 and 10; replaced forms 6 and 7	

Sources: "Profile of American Youth: 1980 Nationwide Administration of the Armed Services Vocational Aptitude Battery," OASD (MRA&L), March 1982.

"Aptitude Testing of Recruits: A Report to the House Committee on Armed Serivces," OASD (MRA&L), July 1980.

Exhibit III-1. SUMMARY OF HISTORY OF MILITARY APPLICANT TESTING

1950 as the basis for classifying the trainability of applicants. A variety of calculation schemes have been used during this time, with the AFQT currently being calculated based on selected scores in the standard aptitude test used to analyze applicant job performance capability.

Applicants are classified by the AFQT into one of five mental categories, with Category I being the highest (representing those in the 93rd percentile and above), and Category V, the lowest (representing those in the 9th percentile and below). The Services do not accept applicants in Category V, and accept only a limited number in Category IV, generally in Category IVA (those between the 21st and 30th percentiles).

Job performance capability has, since World War II, been evaluated through testing for selected aptitudes. Since 1976, the aptitude testing of applicants has been based on the Armed Services Vocational Aptitude Battery (ASVAB). Instituted in 1976 as a cross-Service standard test, it replaced the Service-specific tests in use at that time. The ASVAB was designed to eliminate the previously used two-step testing process by combining the AFQT and job classification in a single test.

The ASVAB is composed of a number of specialized subtests designed to measure existing abilities and knowledge in distinct areas. Two versions of the ASVAB have been used: forms 6 and 7, used from January 1976 to October 1980; and forms 8, 9 and 10, instituted in October 1980 and used until October 1984. At that time, the next revision of the ASVAB, forms 11, 12 and 13 will

come into use. The ASVAB is revised approximately every three years to update the terminology and content of questions. As can be seen in Exhibit III-2, there has also been some change in the selection of subtests composing the battery. The set of ten subtests in forms 8, 9 and 10 is, however, expected to remain the same in the foreseeable future.

As noted before, the ASVAB is used to assign applicants to a mental category as well as evaluate their potential job suitability. Four of the ASVAB subtests are used as the AFQT:

- Arithmetic Reasoning,
- Numerical Operations,
- Paragraph Comprehension, and
- Word Knowledge.

These same tests, as well as the six other subtests are also used by each of the Services to analyze applicant aptitudes for job classification. Specific sets of subtests are determined by each Service as representative of the types of knowledge or ability needed for particular jobs in the Service. The Services construct aptitude composites based on combinations of these subtests, with minimum combined score requirements used as a measure of a specific aptitude or job capability. This approach is used by all of the Services for initial job classification, with more specialized tests for proficiency used for occupations requiring higher skill levels, such as language experts. The Services' aptitude composite schemes are discussed in detail below.

Forms 6 and 7 (1976-1980)	Forms 8, 9 and 10 (1980-1983)
General Science	General Science (GS)
Arithmetic Reasoning	Arithmetic Reasoning (AR)
Work Knowledge	Word Knowledge (WK)
	Paragraph Comprehension (PC)
Numerical Operations	Numerical Operations (NO)
	Coding Speed (CS)
Automotive Information	Automotive Shop (AS)
Shop Information	
Mathematics Knowledge	Mathematics Knowledge (MK)
Mechanical Comprehension	Mechanical Comprehension (MC)
Electronics Information	Electronics Information (EI)
Attention to Detail	
Spatial Perception	
General Information	
Combat Scale	
Attentiveness Scale	
Electronics Scale	
Maintenance Scale	

Exhibit III-2. ASVAB SUBTESTS

B. DESCRIPTION OF SERVICE COMPOSITES

An important requirement for all of the Services is the matching of entrants to occupations. The mechanism for performing the initial matching is the ASVAB.

As previously discussed, the ASVAB subtests are used by the Services in various combinations to represent the types of capabilities required for particular jobs. These composites are designed based on internal Service analysis of tasks and functions related to each entry-level enlisted military occupation.[2/] Emphasis is placed on apprentice-level occupations for several reasons:

- NPS applicants will usually only be eligible for apprentice-level positions;
- journeyman or more advanced occupations may require different aptitudes; and
- the aptitude relationships are generally only indirectly related to job characteristics.

The analysis of the relationship of job tasks and functions to the aptitudes or abilities an individual needs to perform them has not been able to be applied by all of the Services. Therefore, the Services analyze the aptitudes required to successfully complete the training necessary for the entry-level occupation instead. Thus, the relationship is not one of aptitude-to-job, but rather aptitude-to-training-to-job.

Aptitude composites are constructed, and minimum combined scores are set, based on the historic success rates of applicants

2/ This discussion of Service aptitude composites and the subsequent discussion of MCR's aptitude clusters relates only to enlisted personnel, since that group is the focus of MCR's research on this project.

and the probability of individuals with various scores successfully completing their training, given the content and duration of the courses. Incorporated in this analysis is the overall requirement for trained personnel in the related occupations. The impact of attained education is considered in the determination of minimum scores on the particular combinations of aptitude tests, with non-high school graduates usually required to achieve higher scores than holders of high school diplomas. This is because there tends to be a higher rate of training failures for non-high school graduates than for high school graduates.

The Services are continually reviewing and updating their aptitude composites in order to maintain a close relationship between aptitude requirements and related occupations. This relationship is generally reviewed annually, with the score requirements usually reviewed more frequently.

Exhibit III-3 lists the aptitude composites currently used by each of the Services.[3/] Three of the aptitude composites are common among all of the Services: General (sometimes referred to as General Technical), Administrative (sometimes referred to as Clerical), and Electronics. Each Service uses the same sets of subtests for each of these composites; only the minimum score requirements are different.

Exhibit III-4 lists the ASVAB subtests used in each of the Service aptitude composites (see Exhibit III-2 for the names of the subtests). In addition to the three common composites, the

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3/ The Navy aptitude composites are identified, in some cases, by terms developed by MCR for this study due to the need for structural similarity among the composites.

Army	Navy
General Technical	General
Clerical	Administrative
Electronics	Electronics
General Maintenance	Skilled Technical*
Skilled Technical	Nuclear*
Field Artillery	Mechanical Technical*
Combat	
Operators/Food	
Surveillance Communications	
Mechanical Maintenance	

Marine Corps	Air Force
General Technical	General
Clerical	Administrative
Electronics	Electronics
General Mechanical	Mechanical
Field Artillery	
Combat	
Mechanical Maintenance	

* MCR designations

Exhibit III-3. SERVICE APTITUDE COMPOSITES

SERVICE	APTITUDE COMPOSITE	ASVAB SUBTESTS									
		AR	MK	NO	CS	PC	WK	GS	EI	MC	AS
Army Navy Marine Corps Air Force	General/General Technical	X				X	X				
	Administrative/Clerical			X	X	X	X				
	Electronics	X	X					X	X		
Army	General Maintenance		X					X	X		X
	Skilled Technical		X			X	X	X		X	
	Field Artillery	X	X		X					X	
	Combat	X			X					X	X
	Operators/Food			X		X	X			X	X
	Surveillance Communic.			X	X	X	X				X
	Mechanical Maintenance	X							X	X	X
Navy	Skilled Technical	X				X	X			X	
	Nuclear	X	X			X	X	X	X		X
	Mechanical Technical					X	X			X	X
Marine Corps	General Mechanical		X					X	X		X
	Field Artillery	X				X	X			X	
	Combat			X		X	X				X
	Mechanical Maintenance	X							X	X	X
Air Force	Mechanical							X		X	X

Exhibit III-4. SERVICE APTITUDE COMPOSITE SUBTEST COMPOSITION

Services also have varing numbers of other composites, with the Air Force having the fewest (four) and the Army the most (ten). Examination of Exhibit III-4 shows that more than one Service may have an aptitude composite similar in structure (i.e., composed of the same combination of subtests) to another Service composite. Examples of this are the Army's General Maintenance composite and the Marine Corps' General Mechanical Composite, both of which are composed of the Math Knowledge (MK), General Science (GS), Electronics Information (EI), and Automotive Shop (AS) subtests. Conversely, the same name may be used by two Services and yet the composites are not constructed using the same combination of subtests. Examples of this are the Army and Marine Corps Field Artillery and Combat composites. Both composites are used by each of these two Services but do not, in actuality, represent the same set of aptitude requirements. These types of differences (composite name vs. content) had significant influence on MCR's analysis and construction of the aptitude clusters, as will be discussed later.

Exhibit III-4 also illustrates that the Services do not, apparently, have heavy dependence on any particular subtest, but rather have fairly scattered requirements, with the Numerical Operations and Coding Speed subtests used the least and Automotive Shop used the most. It should be mentioned that the assignment of subtests to composites has been made based on Service-provided data. In the case of the Army, Air Force and Marine Corps, information is available on the combination of

subtests and the combined minimum scores required in an aptitude composite in order to qualify for particular schools. The Navy, with a somewhat more complicated system, more directly relates subtests and minimum scores to particular training options, and places less emphasis on specific aptitude composites. For this reason, we have identified and named aptitude composites in the Navy which tend to relate to the training options more than the Navy's formal aptitude composites. Thus, we have identified the Nuclear composite, which relates to the qualifications necessary for nuclear ratings. This training would be in addition to the actual occupation-specific (i.e., rating) training an apprentice would receive. However, given the fact that the Navy has requirements for nuclear qualified ratings, we believed this should be reflected. Further adjustments in the identification of the Navy aptitude composites were made in constructing the aptitude clusters; these are discussed below.

It should also be noted that, in some cases, a Service may have an aptitude composite which is <u>not</u> currently related to occupations within the Service. There are two such cases of "inactive" aptitude composites: the Army's General Technical and the Marine Corps' General Mechanical. In the case of the Army's General Technical, however, applicants must achieve a specified minimum score in order to be acceptable for the Army. While this composite is not used in classifying applicants for particular Army schools, it is used in the overall qualification analysis.

The Marine Corps' General Mechanical has only recently been made inactive, with all of the occupations originally assigned to this composite distributed among the remaining composites.

C. DESCRIPTION OF MCR APTITUDE CLUSTERS

In order to relate the projected manpower supply to the projected manpower demand, a mechanism for translating these estimates into common terms was necessary. This mechanism is the aptitude cluster. The aptitude cluster is intended, at an aggregate level, to represent those characteristics and capabilities identified by each of the Services as "necessary" for the performance of particular military jobs. It reflects the common relationships (i.e., similarity of aptitude requirements based on combinations of subtests) of aptitude composites among the Services. As such, the aptitude cluster, as opposed to the aptitude composite, is non-Service specific. The cluster represents the common characteristics shared by several composites, and is designed to be an aggregation of several aptitude composites.

Given the ability to relate Services' aptitude composites to each other and to represent them at a more aggregate level, it is possible to translate weapon system-specific manpower requirements to the related aptitude cluster. In this translation, the distinctions which are made at the Service level among occupations are blurred, so that those occupations which use the same "types" of people are collectively represented as a single "type" of requirement. Conceivably, within the Services, as well as

among the Services, competition occurs for "types" of people to support specific occupational requirements.

The aptitude clusters can also be applied to the manpower supply projections as a mechanism for tailoring, or characterizing, the projected population. This is necessary in order to add another dimension to the population, the distribution of those capabilities which the population my have and which the Services need in their apprentices. In this use, the aptitude clusters are used in conjunction with historic ASVAB scoring data to show the overall distribution of aptitudes in the projected population.

Given the aggregate nature of the aptitude clusters, it was necessary to identify the characteristics common among the Services' composites. As can be seen from the preceeding discussion, the Services' aptitude composites vary widely in numbers and composition.

Exhibit III-4 shows that the distribution and variety of subtest combinations at the subtest level of detail was not a functional level at which to identify common characteristics. Initial consideration of the content of the subtests indicated that it was possible to group the subtests. This grouping is based on the similarity of the knowledge groups the subtests are addressing. There are two studies which have statistically analyzed these relationships.[4/]

4/ Dr. Darrell Bock of the University of Chicago has studied these relationships using the 1980 Profile of American Youth data. The Army Research Institute analysis is documented in Factor Structure of the Armed Services' Vocational Aptitude Battery (ASVAB), Forms 8, 9 and 10: 1981 Army Applicant Sample.

The relationships developed from the Profile of American Youth data were selected since they are based on the same data base used in developing MCR's manpower supply projections, and each subtest is assigned to a single subtest group, rather than more than one group. Four groups of subtests were used:

- Math, composed of Arithmetic Reasoning (AR) and Math Knowledge (MK);
- Speed, composed of Numerical Operations (NO) and Coding Speed (CS);
- Verbal, composed of Paragraph Comprehension (PC), Word Knowledge (WK), and General Science (GS); and
- Technical, composed of Electronic Information (EI), Mechanical Comprehension (MC), and Automotive Shop (AS).

The Services' aptitude composite/subtest combinations were arrayed according to these subtest groupings and are shown in Exhibit III-5.

The approach MCR adopted in grouping the Service aptitude composites, according to the way in which the composite subtests align in the four groups, was used for several reasons. First, the major intention of this analysis was to demonstrate that such a structure is possible and that it provides additional insight into the aptitude characteristics of populations. It is not intended to be rigorously statistically validated, but rather to be the starting point for additional investigations, which may be more statistically oriented.

Second, this approach is designed to be consistent with how the Services currently use aptitude composites. It extends the

APTITUDE CLUSTER	SERVICE	APTITUDE COMPOSITE	ASVAB SUBTESTS									
			MATH		SPEED		VERBAL			TECHNICAL		
			AR	MK	NO	CS	PC	WK	GS	EI	MC	AS
General	Army	General Technical	X				X	X				
	Navy	General (Basic)	X				X	X				
	Navy	General (Electronics)	X	X					X			
	Marine Corps	General Technical	X				X	X				
	Air Force	General	X				X	X				
Administrative/ Clerical	Army	Clerical			X	X	X	X				
	Navy	Administrative			X	X	X	X				
	Marine Corps	Clerical			X	X	X	X				
	Air Force	Administrative			X	X	X	X				
Technical	Army	Electronics	X	X					X	X		
	Navy	Electronics	X	X					X	X		
	Marine Corps	Electronics	X	X					X	X		
	Air Force	Electronics	X	X					X	X		
	Army	General Maintenance		X					X	X		X
	Marine Corps	General Mechanical		X					X	X		X
	Army	Skilled Technical		X			X	X	X		X	
	Navy	Skilled Technical	X				X	X			X	
	Marine Corps	Field Artillery	X				X	X			X	
	Navy	Nuclear	X	X			X	X	X	X		X
Mechanical	Navy	Mechanical Technical					X	X			X	X
	Air Force	Mechanical							X		X	X
Mechanical Maintenance	Army	Mechanical Maintenance	X							X	X	X
	Marine Corps	Mechanical Maintenance	X							X	X	X
Combat	Army	Field Artillery	X	X		X					X	
	Army	Combat	X			X					X	X
Field	Army	Operators/Food			X		X	X			X	X
	Army	Surveillance/Communic.			X	X	X	X				X
	Marine Corps	Combat			X		X	X				X

Exhibit III-5. RELATIONSHIP OF APTITUDE COMPOSITES TO APTITUDE CLUSTERS

current Service approaches to illustrate that composites may have relationships among themselves, both inter- and intra-Service. Since the purpose of this analysis does not include examination of the specific relationships among the occupations, training and associated composite, no attempt was made to extend these definitions into these areas. However, clearly this is a potential course of investigation.

Finally, extensive statistical analyses have been performed of the content relationships of the ASVAB Forms 8, 9, and 10, the ASVAB version which forms the basis for the current aptitude clusters. These are considered a sufficient statistical base for development of definitions of the current clusters.

As noted earlier, all four Services have three composites which are structurally composed of the same set of subtests and are, therefore, common to all. These are the General, Administrative/Clerical and Electronics composites. Using the subtest grouping approach, it can be seen, however, that there are additional cases of common characteristics among several composites. These relationships among composites have been based on the combination of subtests in the four groups. This means that although one composite may use one subtest in a group, and another composite may not use the first subtest but does use another subtest in the same group, the two composites are considered related. Based on this analysis of subtest selections by group, all of the composites have been related to each other and assigned to one of seven aptitude clusters.

As discussed earlier, some analytical judgement was used in defining and assigning the Navy composites. Analysis at the subtest level assigned a number of very skilled electronics occupations to the Navy Skilled Technical and Electronics composites, although structurally they were not quite compatible. Analysis according to subtest groups allowed for the splitting out of these occupations into a separate composite, called here General (Electronics).

In addition to combinations of subtests, aptitude composites are also defined by the minimum combined scores required to qualify for occupations (i.e., training) in the composites. Within the composite, individual occupations are assigned minimum required scores. In order to determine the proportion of the population qualifying in each aptitude composite, it was necessary to select criteria for this qualification. A minimum combined score was identified for each aptitude composite based on analysis of the occupation qualification scores used by each Service. (The list of apprentice occupations in each Service by aptitude cluster and minimum score is in Appendix D.) In those cases where large differences exist in the minimum combined score requirements for groups of occupations in a composite, the composite was restructured for MCR's analysis to reflect this. Thus, the Navy/General (Basic) and Navy/General (Electronics) composites belong to the same cluster, based on the analysis of their subtest requirements. However, they are different composites, not only due to differences in subtest combinations,

but also due to the large differences in the score requirements. A single minimum combined score was determined, based on analysis of the overall bottom end of the score range, for each Service composite in each cluster. These are shown in Exhibit III-6. These combinations of subtests and scores, expressed as individual composites and as cluster qualification scores, were used as the basis for refining the population projections of the non-prior service youth (17-21 year olds) and the military enlisted apprentice projections.

In order to develop the necessary sample aptitude composite and cluster qualification rates for the NPS youth and enlisted apprentice populations, the definitions of the composites and clusters were applied to the civilian and military data bases. The Profile of American Youth study was used to represent NPS youth, also referred to here as the civilian population. The enlisted apprentice rates were developed from analysis of the FY81 and FY82 military accession data bases, maintained by the Defense Manpower Data Center (DMDC). The composite and cluster qualification definitions were applied to these data bases through a two-step process to produce the sample qualification rates used in the third part of the PROMANSA model.

In the first step, the test results in the three data bases were reviewed to determine if the individuals in the selected age groups met the minimum combined score requirements in each composite. Based on this analysis, composite qualification rates were developed for the NPS youth and enlisted apprentice populations.

Aptitude Cluster	Service	Aptitude Composite	Related ASVAB Subtests							Minimum Score*	Application Rules
General	Army	General Technical	AR	PC	WK					N/A	• Not Applicable to Classif.
	Navy	General (Basic)	AR	PC	WK					90	• 90 for Basic Ratings
	Navy	General (Elect.)	AR	MK	GS					200	• 200 for Gen. Elect. Ratings
	Marine Corps	General Technical	AR	PC	WK					92	• Combined Scores
	Air Force	General	AR	PC	WK					87	• Combined Scores
Administrative/ Clerical	Army	Clerical	NO	CS	PC	WK				138	• Combined Scores
	Navy	Administrative	NO	CS	PC	WK				149	• Combined Scores
	Marine Corps	Clerical	NO	CS	PC	WK				131	• Combined Scores
	Air Force	Administrative	NO	CS	PC	WK				142	• Combined Scores
Technical	Army	Electronics	AR	MK	GS	EI				175	• Combined Score
	Navy	Electronics	AR	MK	GS	EI				156/212	MK+GS+EI=156(+AR=212)
	Marine Corps	Electronics	AR	MK	GS	EI				182	• Combined Scores
	Air Force	Electronics	AR	MK	GS	EI				181	• Combined Scores
	Army	General Mtnce	MK	GS	EI	AS				177	• Combined Scores
	Marine Corps	General Mech	MK	GS	EI	AS				N/A	• Not Applicable to Classif.
	Army	Skilled Technical	MK	PC	WK	GS	MC			178	• Combined Scores
	Navy	Skilled Technical	AR	PC	WK	MC				146	• Combined Score with Multiple Rating-Specific Variations
	Marine Corps	Field Artillery	AR	PC	WK	MC				139	• Combined Scores
	Navy	Nuclear	AR	PC	WK	GS	MK	EI	AS		
			AR	PC	WK					115	Must meet all of these qualifications
			AR	2MK	GS					200	
			AR	MK	GS	EI				156/218	MK+GS+EI=156(+AR=218)
			MK	AS						94	
Mechanical	Air Force	Mechanical	GS	MC	AS					173	• Combined Scores
	Navy	Mechanical Tech.	PC	WK	MC	AS				145	• Combined Scores
Mechanical Maintenance	Army	Mech. Mtnce	AR	EI	MC	AS				179	• Combined Scores
	Marine Corps	Mech. Mtnce	AR	EI	MC	AS				167	• Combined Scores
Combat	Army	Field Artillery	AR	MK	CS	MC				177	• Combined Scores
	Army	Combat	AR	CS	MC	AS				178	• Combined Scores
Field	Marine Corps	Combat	NO	PC	WK	AS				131	• Combined Scores
	Army	Operators/Food	NO	PC	WK	MC	AS			180	• Combined Scores
	Army	Surveillance/Comm	NO	CS	PC	WK	AS			191	• Combined Scores

*Minimum Score=Sum of Standard Scores

Exhibit III-6. DEFINITIONS OF MCR APTITUDE CLUSTERS

In the second step, sample aptitude cluster qualification rates were developed. Within each cluster, there may be more than one combination of subtests making up the various composites in the cluster. In order to determine the qualification rates for the seven clusters, it was necessary to determine if individuals qualified in any one of the different combinations of subtests included in the cluster. Seventeen unique subtest combinations were identified within the 26 composites. These 17 combinations were used to determine the cluster qualification rates. For example, in order to qualify for the Technical cluster, an individual could qualify in any one of six ways. The arrows in Exhibit III-6 show the 17 subtest combinations used to develop the aptitude cluster qualification rates. Potential applications of this kind of analysis are discussed in the following section.

IV. POTENTIAL APPLICATIONS AND IMPLICATIONS

This section describes a set of data formats which may be developed using the Aptitude Cluster qualification criteria, and addresses the potential applications of the Aptitude Cluster concept and potential implications for the use of the PROMANSA Model and Aptitude Cluster concept.

A. QUALIFICATION RATE FORMATS

The aptitude composite and cluster qualification rate analysis provides a key input to the PROMANSA model: the NPS youth and enlisted apprentice aptitude qualification rates. These rates are applied to the projected populations developed in the first two parts of the model, the NPS Youth Population Calculation and the Force Structure Model. The output of these two calculations are the total numbers of NPS youth (17 to 21 year olds) and the projected estimate of military accessions, apprentices, and journeymen.

In order to verify the utility of this approach, the enlisted apprentice aptitude composite and cluster qualification criteria were applied to two populations: the Profile of American Youth study, representing the civilian non-prior service youth population, and the FY81 and FY82 military accessions. Formats illustrating the various types of results which can be generated from this analysis have been developed. Samples of these formats are discussed in this section.

Two types of aptitude qualification rates can be developed for the NPS youth and enlisted apprentice populations: aptitude composite qualification rates and aptitude cluster qualification rates. The composite qualification rates represent the percentages of the civilian and military apprentice populations qualifying for each of the Services' aptitude composites. The aptitude cluster qualification rates represent the percentage of each of the two populations qualifying for the more aggregate clusters. The composites are based on the definition of the Services' aptitude composites in current use (circa 1982), while the cluster rates are based on the definition of the cluster/composite groupings developed by MCR. Examples of formats illustrating both the composite and cluster qualification rates are included in this discussion.

In this study the aptitude composite and aptitude cluster qualification analysis has been based on applying these definitions to the civilian and military population data bases previously used in the PROMANSA model estimates: the Profile of American Youth (PAY), weighted to represent a total American youth population of 33.5 million, and the FY81 and FY82 DMDC Military Accessions Files. The purpose of this analysis was to demonstrate that the aptitude characteristics of populations could be identified and analyzed, and that these aptitude characteristics could be arrayed according to selected demographic characteristics. While the qualification rates by age are the only input requirements for the PROMANSA model, we believe analysis of the other demographic characteristics provides

potentially valuable insight into relevant aspects of population aptitudes. Examples of the types of analyses which can be performed have been included in this discussion for illustrative purposes only and are not intended to represent definitive results.

The aptitude cluster and composite definitions have been applied to the Civilian Youth and the Military Accessions populations data bases. This allowed us to determine if the the number of individuals with scores necessary to qualify in each of the aptitude clusters and in each composite within the cluster could be identified. This analysis of potential qualification rates is intended to demonstrate the types of analyses it is possible to conduct, given available information. However, the determination of long-term trends would require more extensive longitudinal data than examined here.

In addition to the ASVAB test results, the data bases also contained demographic information. Data on the age, sex, race, and census region of origin of the person were also included. This same set of demographic characteristics can be analyzed for both groups, and qualification rates can be developed by demographic characteristic.

1. Aptitude Composite Qualification Rate Formats

As noted above, two types of formats can be developed in the aptitude qualification analysis: composite and cluster formats. Composite formats array the data for each composite in a cluster, by cluster. The composites are grouped by cluster, as shown in Exhibit III-5.

This format grouping allows for an analysis of the composites which the Services have designed with similar characteristics. It is important to note that while these composites may be structurally similar it does not mean that the skills they represent are similar, or that the occupation for which they are used to classify applicants are similar. Two examples of this fact are the Marine Corps Field Artillery composite, which is in the Technical Cluster, and the Army Field Artillery composite, which is in the Combat cluster, along with the Army Combat composite. The Marine Corps Combat composite, however, is in the Field Cluster. MCR did not attempt to investigate the reasons for such anomalies; nor does their existence necessarily portend a cause for concern.

While anomalies such as these may show up when composites are arrayed in this manner, clustering of the aptitude composites is also useful because it allows analysts in each of the Services to see the other Services' composites which are structurally similar. Thus Service manpower planners, for example, can consider the types of personnel for which they are all competing, in terms of the qualification criteria used to

identify these applicants. This examination can be conducted to the level of specific occupation, since all of the Services relate entry-level occupations to each composite. Appendix D lists each of the Services' entry-level occupations by aptitude cluster and minimum ASVAB subtest score requirement.

Exhibits IV-1 and IV-2 are examples of formats which can be used to illustrate qualification rates by age. As with all of the sample formats, bar charts have been used to graphically illustrate the proportion of individuals in each group qualifying in a composite, although in all samples no actual rates are shown. For both the civilian and military sample populations, the qualification rates can be given in terms of the age group with the highest percentage of people qualifying for each composite; and the age group with the lowest percentage of qualifiers. All of the other age groups will fall somewhere in between the high and low scoring age groups. Exhibit IV-1 shows an example in which a single age group scores the highest and another age group scores the lowest, in each composite. In this case, the same age groups score high and low in all of the composites, although this will not necessarily always be the case.

Exhibit IV-2 shows examples of cases where more than one age group scores the same high or low score. While this may seem unusual, it was found to be a frequent occurrence in the analysis of the sample populations. In cases in which multiple ages score the same, the pattern representing each age group is

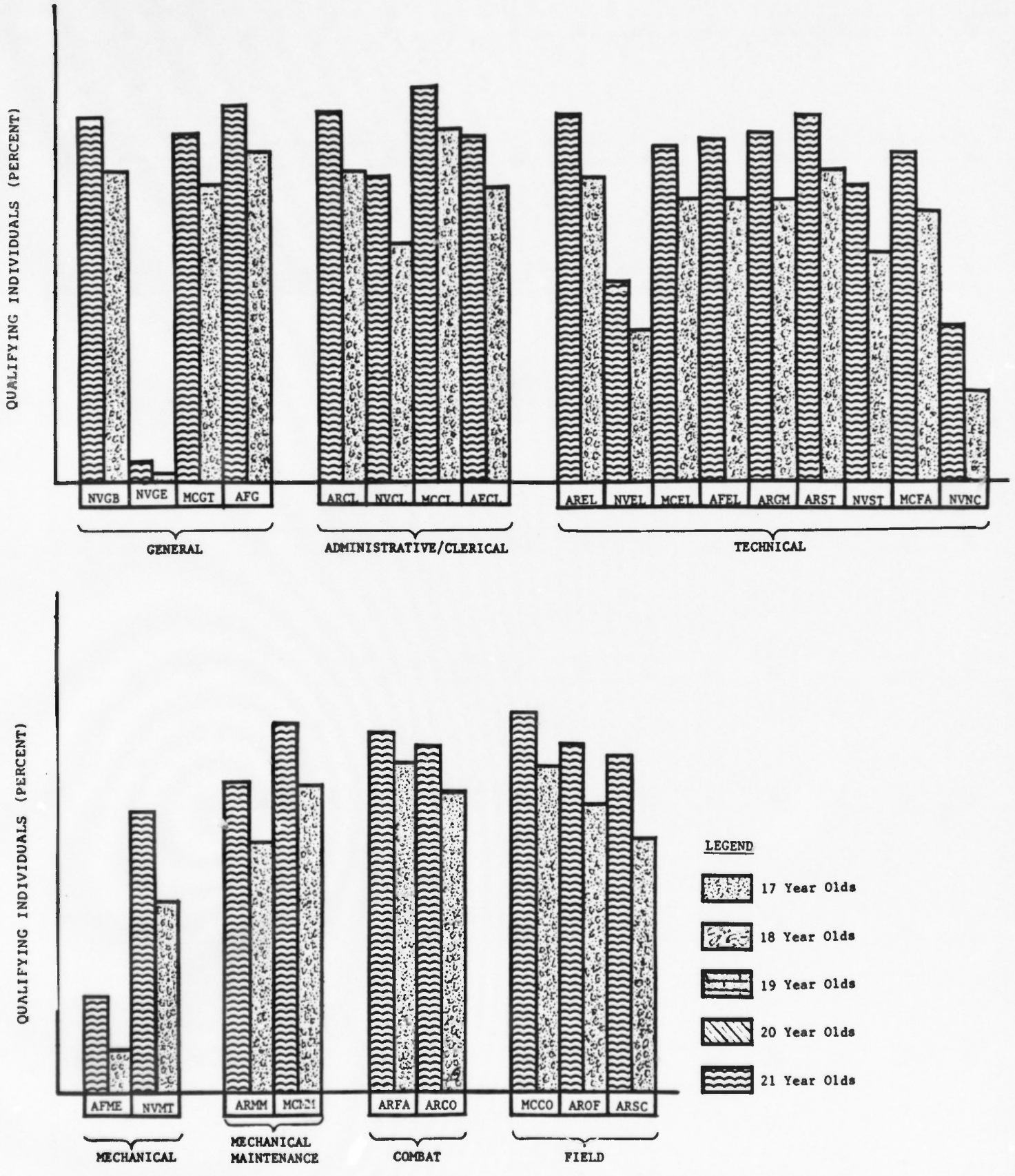

Exhibit IV-1. SAMPLE APTITUDE COMPOSITE ANALYSIS FORMAT: CIVILIAN YOUTH POPULATION BY AGE (HIGH AND LOW)

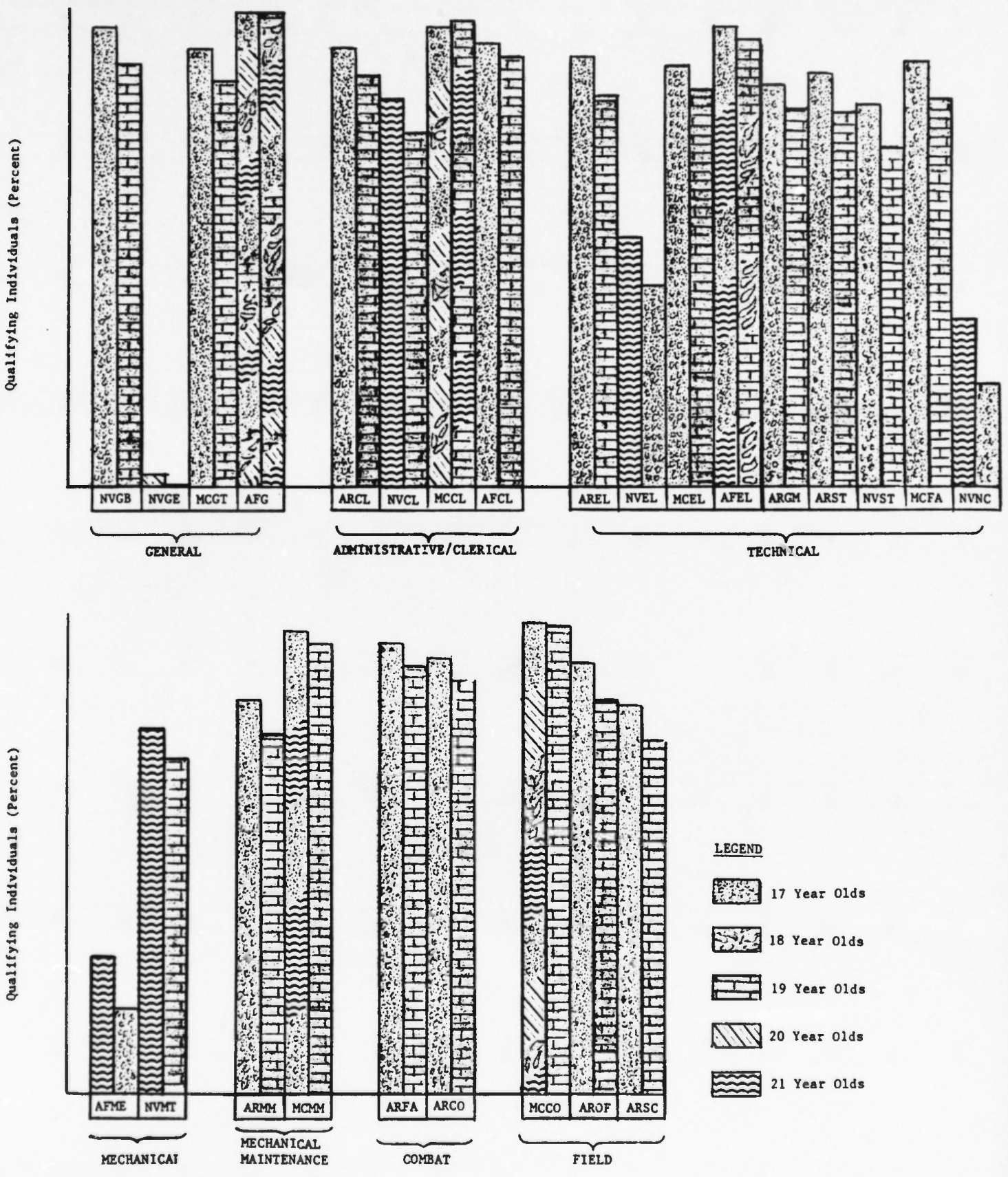

Exhibit IV-2. SAMPLE APTITUDE COMPOSITE ANALYSIS FORMAT: MILITARY ACCESSIONS BY AGE (HIGH AND LOW)

shown in diagonal stripes of the same width. An unusual occurrence is shown for the Air Force General (AFG) composite[5/] in which all five age groups had the same qualification rate. In this case all five patterns appear in both columns, and the columns are the same height (representing the same rate). A more usual result is shown for Marine Corps Mechanical Maintenance, in which two ages (17 and 21 year olds) scored the highest, and a single age (19 year olds) scored the lowest.

This same type of multiple-pattern bar chart can also be used to graph qualification rates by race, where more than one race may have the same rate, or where all of the races may be represented on the same chart.

Exhibit IV-3 illustrates a format for representing the qualification rates by sex for each composite. (Formats for the following examples are for the military accessions, as there will be no difference in formats for the civilian or military populations.) For each composite, the rate at which males and females qualified is shown. This format allows for the comparison of qualification rates by gender for a given composite, with all of the relevant data displayed.

5/ The codes used to identify the Service composite combinations are a simple shorthand for the composites listed in Exhibit III-6 (e.g., NVGB stands for Navy/General (Basic). A list of these codes and the related composites are given in Appendix C.

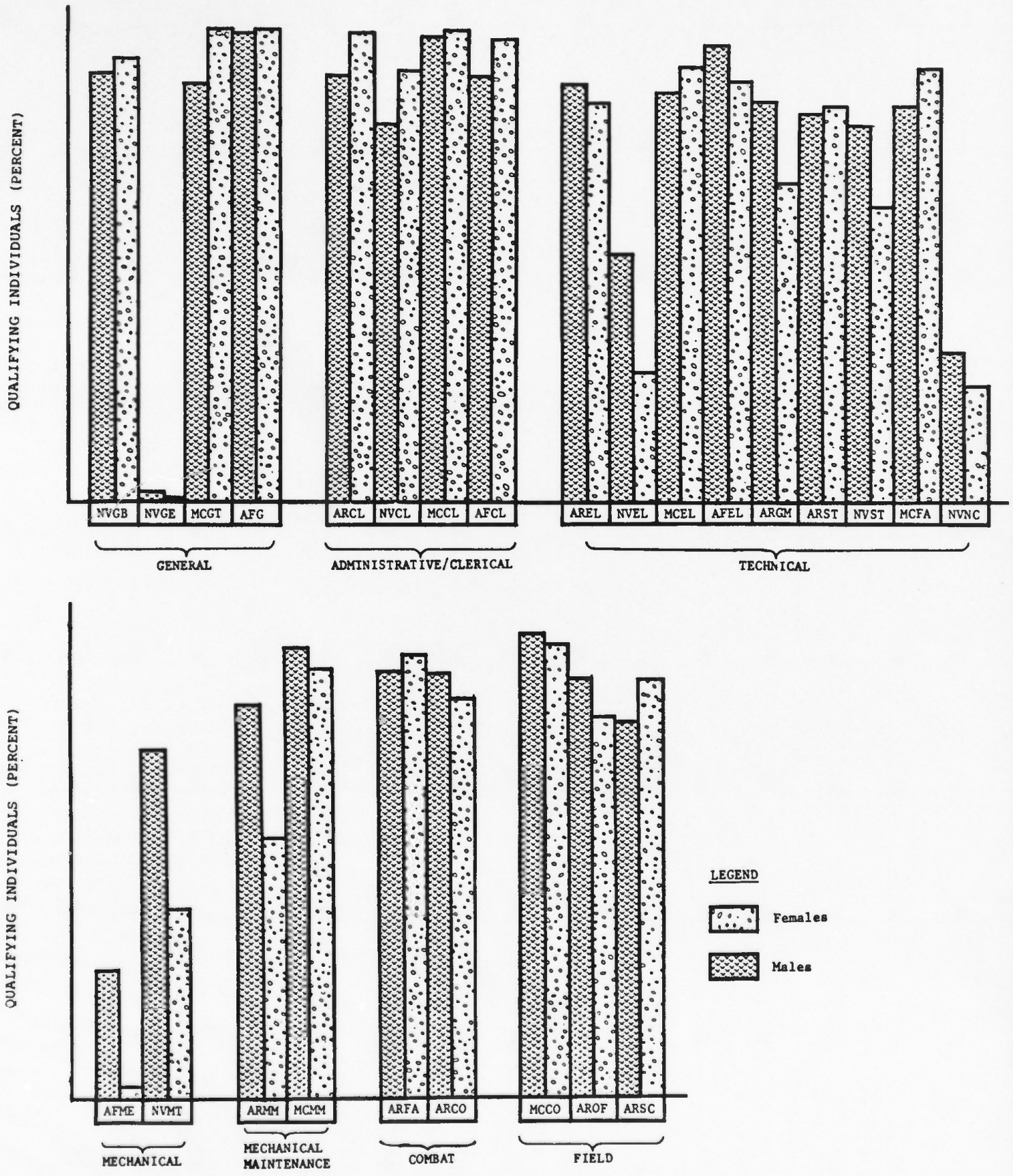

Exhibit IV-3. SAMPLE APTITUDE COMPOSITE ANALYSIS FORMAT: MILITARY ACCESSIONS BY SEX

The fourth characteristic which can be used to analyze the civilian and military populations is the geographic census region of the person's home. Exhibit IV-4 depicts the nine census divisions in the United States, as defined by the Bureau of the Census. Background on the definition of these divisions is provided in Appendix E. Exhibit IV-5 illustrates the sample format for the census region qualification rates. It is similar to the age rate analysis in that multiple patterns, representing each census region, are used to illustrate the high and low qualification rates. As was noted in the qualification rate by age, it is possible for more than one geographical region to have the same proportion of applicants qualifying in a given composite. As before, multiple patterns are used to indicate cases where more than one census division has the same qualification rate.

2. Aptitude Cluster Qualification Formats

As noted earlier, the second type of qualification rate which can be developed using the aptitude cluster concept is qualification rates by aptitude cluster. The aptitude clusters developed in this study were designed to expand the current capability of OSD and the Services to analyze and project aptitude requirements and availability. By recognizing that more general characteristics are common across the various Service composites, it is possible to consider the aptitude requirements shared by all of the Services. The use of the aptitude clusters

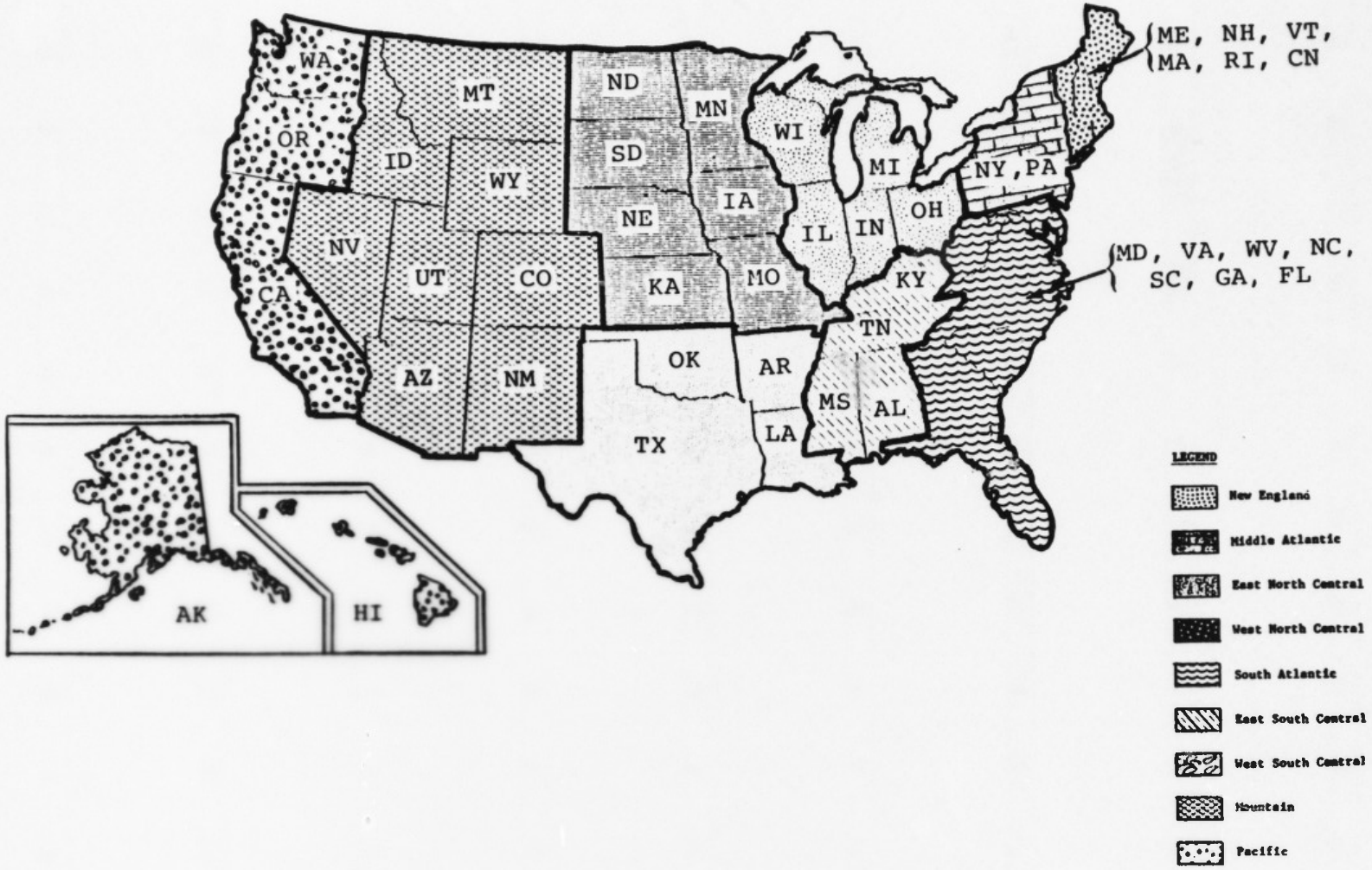

Exhibit IV-4. STATES IN EACH CENSUS DIVISION

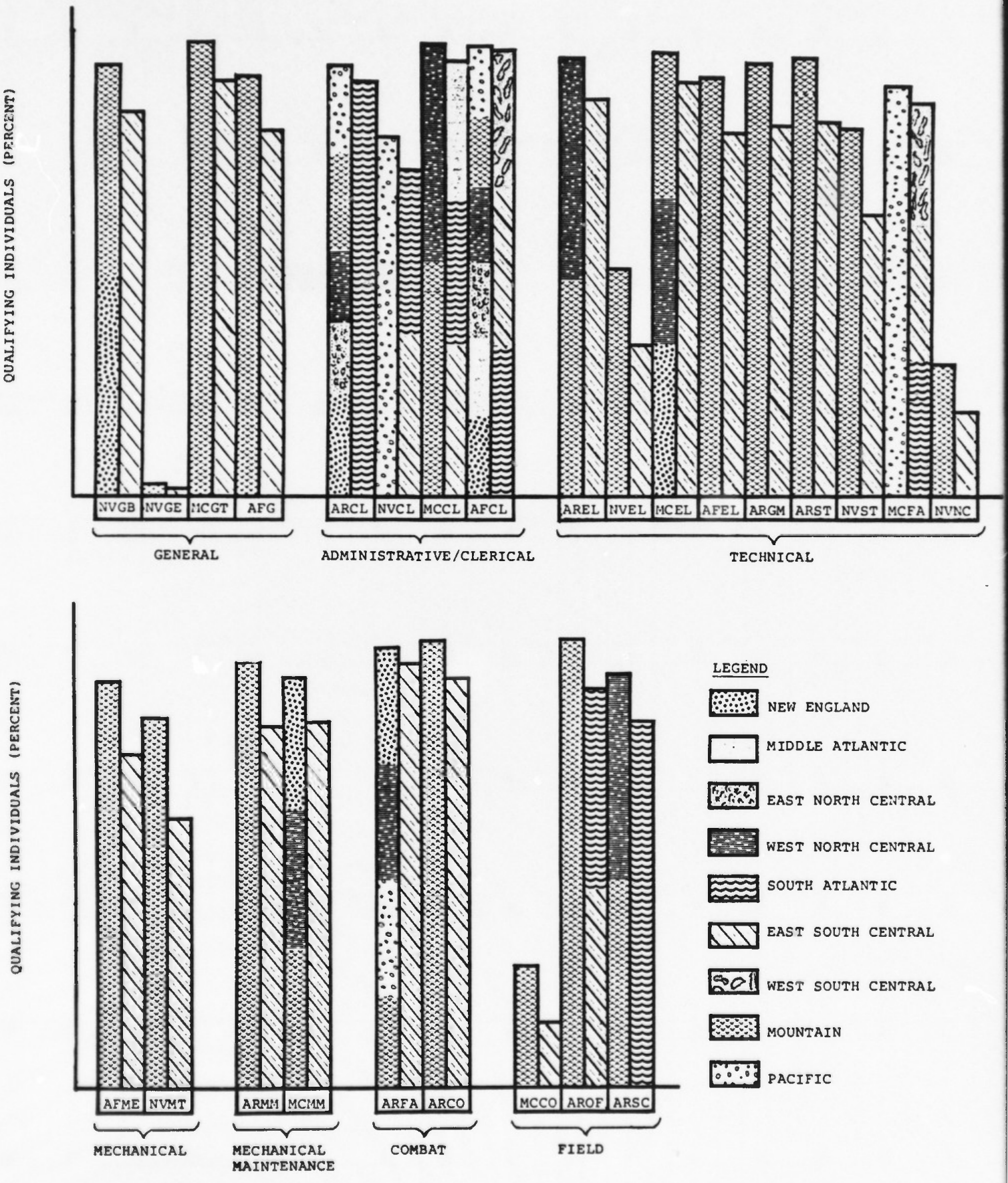

Exhibit IV-5. SAMPLE APTITUDE COMPOSITE ANALYSIS FORMAT: MILITARY ACCESSIONS BY CENSUS DIVISION (HIGH AND LOW)

also allows for the consideration of the broader trends associated with the demographic characteristics. In addition, it reinforces the consideration of the fact that anomalous composites, such as the Navy/General (Electronics), still share characteristics with other composites within the same cluster. This is important in the consideration of the implications of the competition for particular "types" of personnel which occurs within and among the Services. Finally, aptitude clusters allow for the consideration of the availablity of the overall "aptitude type" which is identified with the particular occupations represented by the Services' composites.

As explained in the description of the inputs to the PROMANSA Model, the age-specific aptitude cluster qualification rates play a critical role. These rates form the basis for projecting the general aptitude composition of the outyear population.

In developing the aptitude cluster qualification rates, the analysis of the composite qualification rates was slightly modified. The unique combinations of subtests and score requirements for the group of composites in each cluster were identified. Then the sample populations were reviewed to determine the percentage of individuals who qualified for a cluster by fulfilling the criteria for any one of the unique combinations of composite criteria. As with the composite analysis, it is important for the analyst to recognize that a certain amount of double counting of individuals who qualify for more than one composite

or cluster is unavoidable without special screening precautions being taken. For the test analysis conducted for this study, no such precautions were taken. The aptitude cluster analysis shows a more general set of characteristics for the population, blurring the anomalous nature of unusually structured composites such as Navy/General (Electronics).

Exhibits IV-6 and IV-7 show the aptitude cluster qualification rate formats for the civilian and military populations. The format for the civilian youth qualification rates illustrates that the data base used in the validation analysis (the Profile of American Youth study) contained ages other than those of direct interest in the aptitude composite analysis, but which are of general interest in considering aptitude cluster qualificaiton rate characteristics. The basic age range of 17 to 21 year olds is shown in both exhibits in the same patterns used in the composite analysis. The ages at the ends of the range are shown in contrasting geometric patterns.

Exhibits IV-8 and IV-9 depict formats for showing the qualification rates for the sex and the census region demographic analyses. These are structurally similar to the analogous composite formats. The major difference is that each chart represents a single cluster and, therefore, all of the nine census regions can be represented on a single chart, as opposed to only being able to represent the high and low qualifying regions.

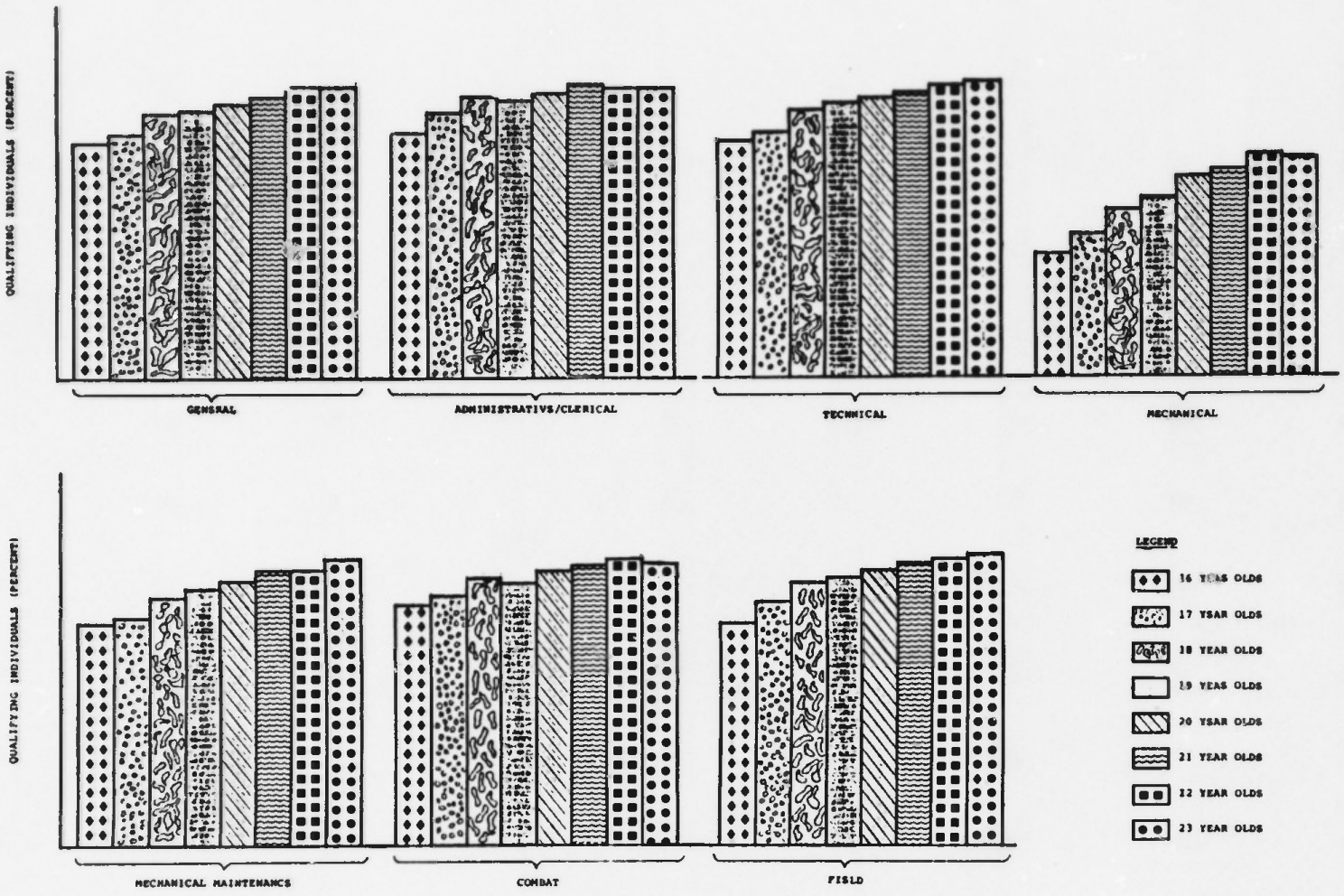

Exhibit IV-6. SAMPLE APTITUDE CLUSTER ANALYSIS FORMAT: CIVILIAN YOUTH POPULATION BY AGE

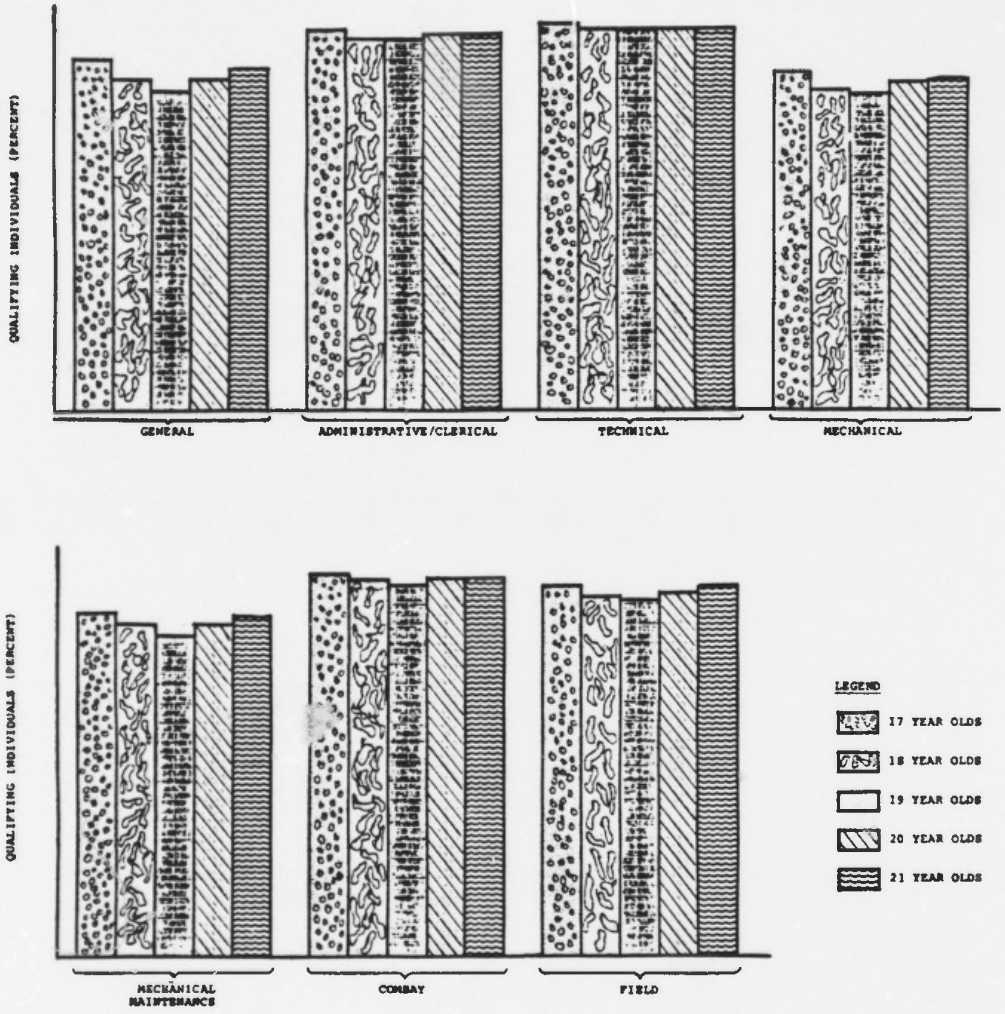

Exhibit IV-7. SAMPLE APTITUDE CLUSTER ANALYSIS FORMAT: MILITARY ACCESSIONS BY AGE

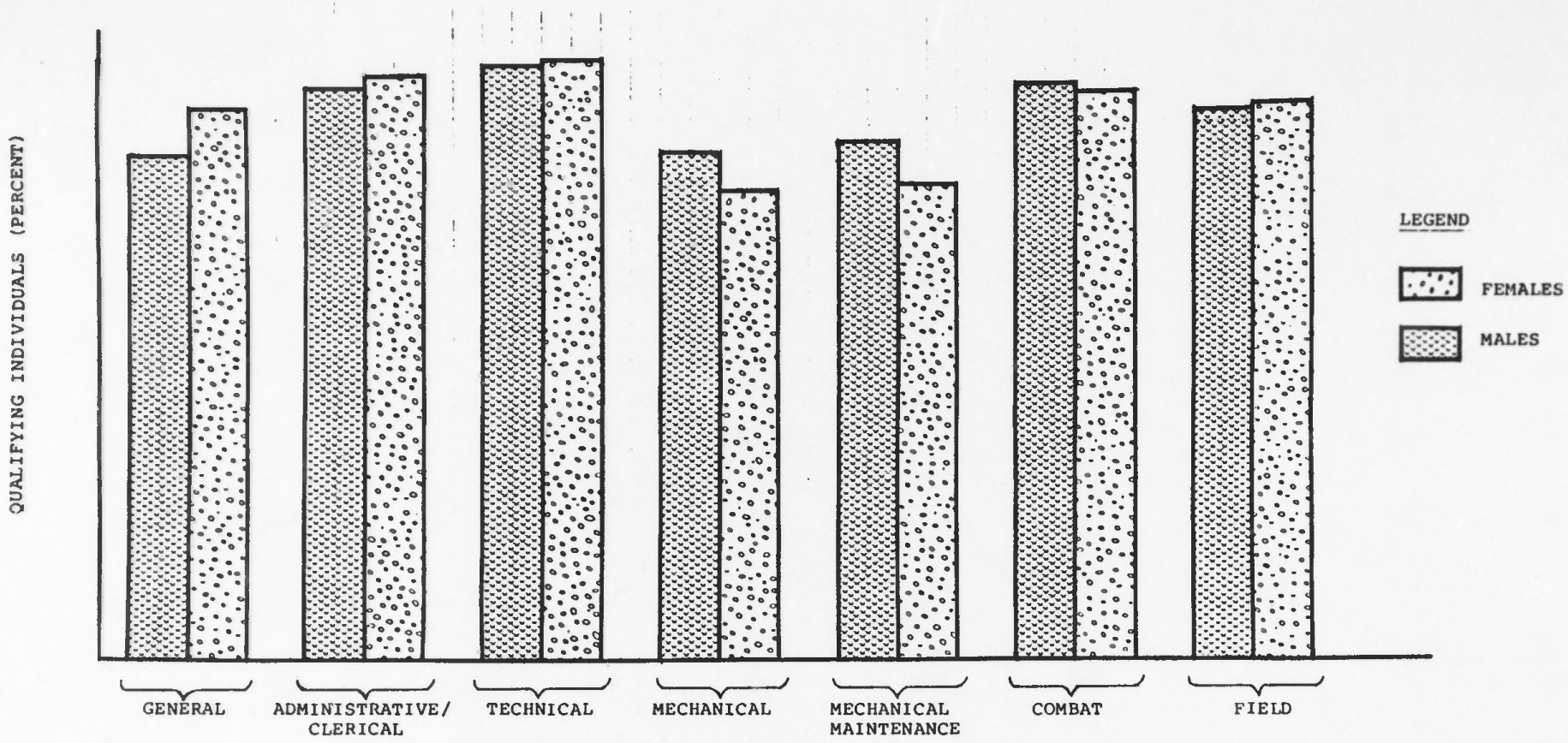

Exhibit IV-8. SAMPLE APTITUDE CLUSTER ANALYSIS FORMAT: MILITARY ACCESSIONS BY SEX

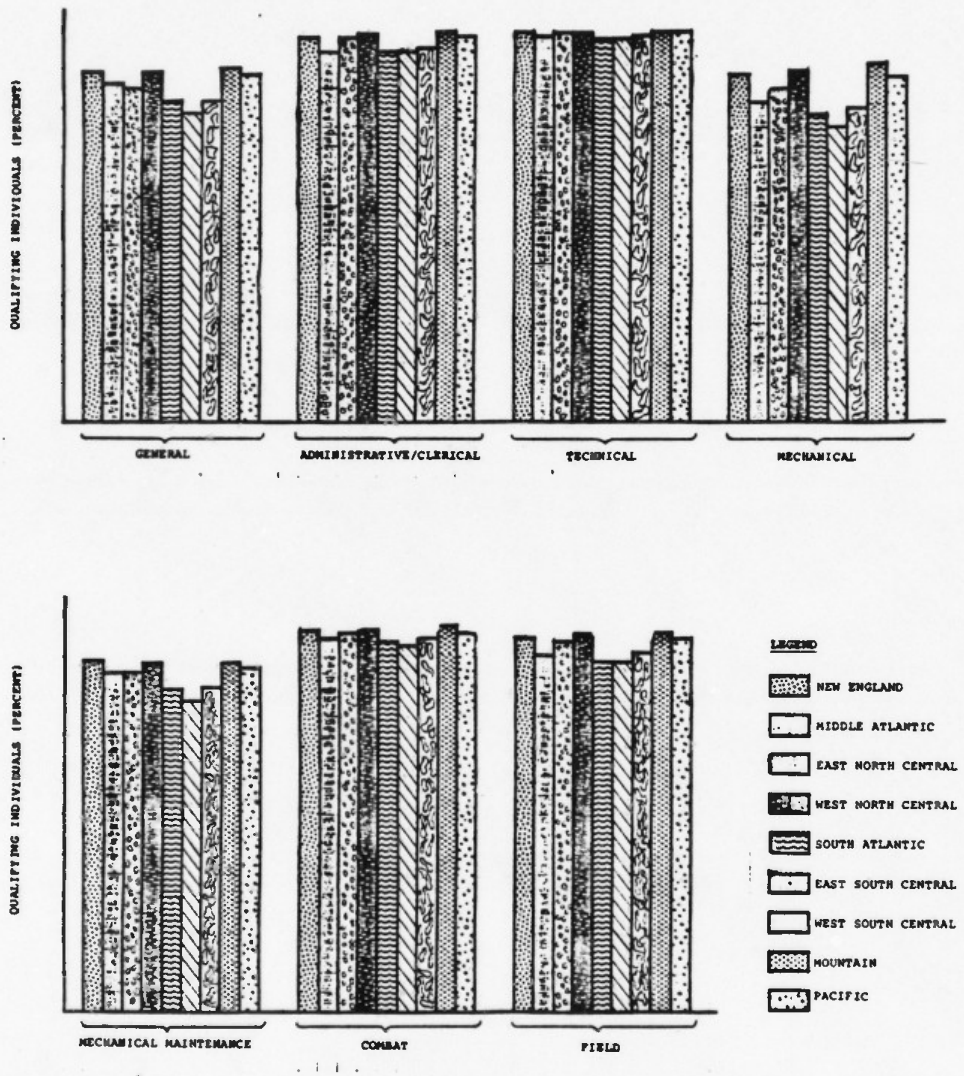

Exhibit IV-9. SAMPLE APTITUDE CLUSTER ANALYSIS FORMAT: MILITARY ACCESSIONS BY CENSUS DIVISION

B. POTENTIAL APPLICATIONS

Only a few of the potential uses of the Aptitude Cluster concept have been explored in the course of the construction and validation of this concept. There are a number of other more sophisticated analyses which can be conducted using this approach and which would be beneficial to specific members of the military manpower planning community. A few of these are presented below.

In the validation analysis of the aptitude composite and cluster qualification rates, a very streamlined approach was taken. This was because the purpose was to determine if reasonable information could be obtained from such an analysis. While not all of the results have been included in this study, preliminary results presented to members of the Services' analytical community indicated that there were a number of additional avenues of related investigation which could be fruitful. The demographic analysis was limited to examining the variables individually. Of significant interest is the correlation of the multiple variables, that is the proportion of individuals who qualify on more than one composite. A related aspect of interest is the degree of difficulty associated with the various composites, and if individuals qualifying for certain composites have a tendency to qualify for other composites--are smart people tending to be smart in a number of areas?

Another significant area of potential interest concerns the relationship of occupations to composites and clusters. Examination of the Services' occupation assignments by composite and related cluster indicates that different Services have similar

occupations in different composites/clusters. This raises questions concerning the types of skills the Services consider to be necessary to successfully complete initial training for an occupation. It should be noted that in most cases job-specific tasks are learned via OJT, not school-house training. Several of the Services have been involved in the in-depth analysis of the skills required to adequately perform a specific job, versus successful completion of training. Much work has been performed in this area since the completion of this study. However, the aptitude clustering concept may shed additional light on the different ways in which similar occupations are thought of by the Services. It is recognized that the construction of aptitude composites is a responsibility of the Services, not OSD.

Undoubtedly there are many more possible applications of the aptitude cluster concept than the few mentioned in this report. Hopefully, OSD and the Services will continue to explore potential applications. The following section addresses some of the policy implications associated with potential applications of the Aptitude Cluster concept.

C. IMPLICATIONS

In the 30-year period from 1980 to 2010, the size of the U.S. youth population (17 to 21 year olds) is expected to exhibit dramatic fluctuations. Exhibit IV-10 contains a projection of the number of NPS youth in the U.S. through 2010. The size of the NPS youth population, which is the primary source of

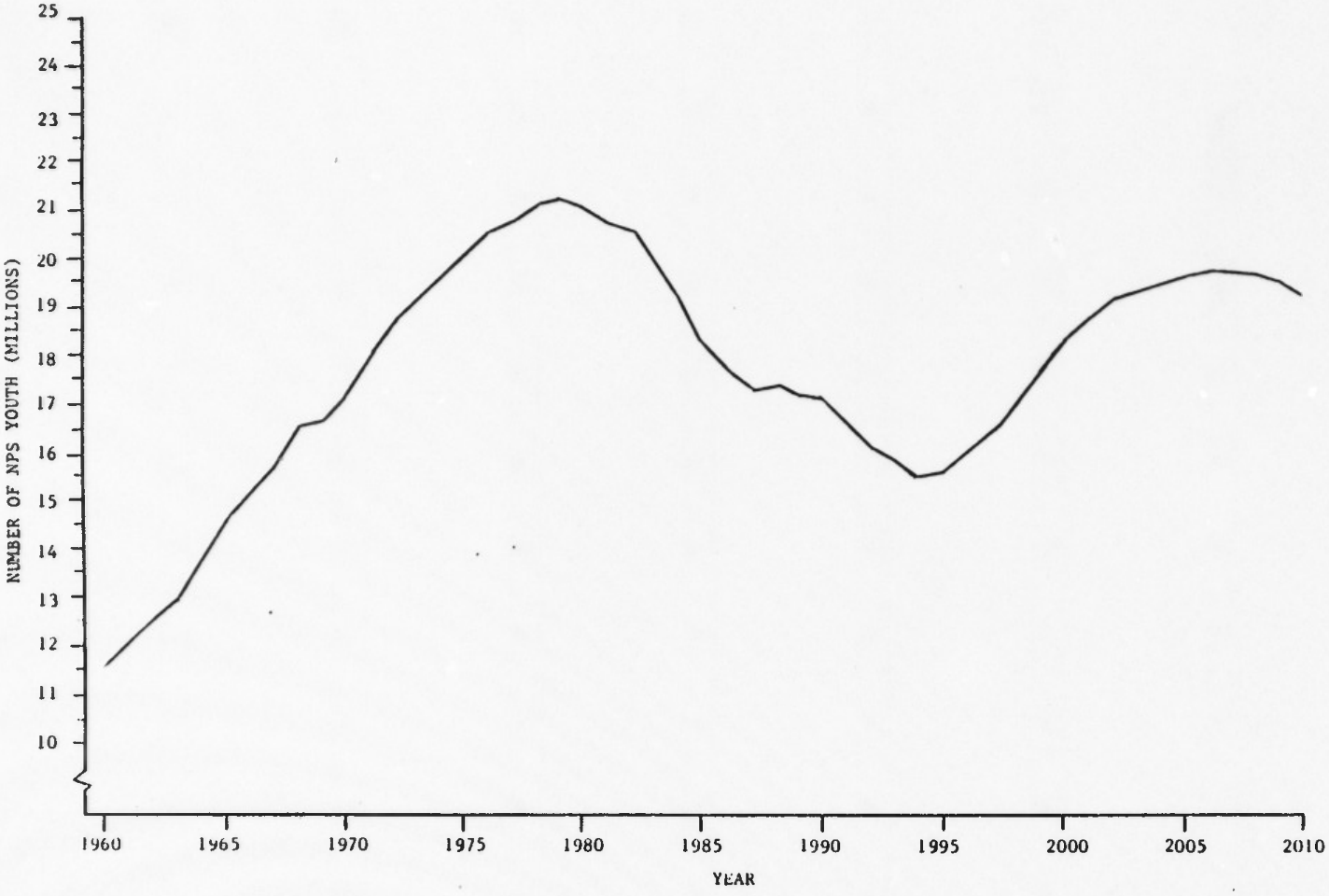

Exhibit IV-10. POPULATION OF 17 TO 21 YEAR OLDS IN THE UNITED STATES: 1960 TO 2010

individuals entering military service, is expected to decrease by 25% from 1982 to 1994. Although the size of that population is expected to increase between 1994 and 2010, it is not expected to reach 1982 levels before 2010.

This situation poses significant questions for military manpower planners. Recruiting questions aside, the implications for force readiness and sustainability are critical. Without decreases in requirements or increases in retention, the Services may face significant shortfalls in fill rates in the late 1980's and early 1990's.

In order to properly scope a set of strategies for avoiding, or at least ameliorating, manpower shortfalls, it is important for military manpower planners to be able to accurately project manpower demand well into the future. That capability is currently being developed by OASD (MI&L) and the Services. However, the demand for personnel, even if specified by type of capability required, is not enough. One must also understand the skill content of the manpower supply well enough to fully assess the implications of recruiting requirements, accession rates, training leadtimes, expected personnel productivity, and retention rates.

This study takes a step in that direction. The analysis documented in this report was structured to provide insights into the aptitude content of the NPS youth population. As a corollary, the analysis also led to the derivation of a scheme for projecting the aptitude content of apprentice-level military personnel.

As discussed above, the aptitude content of the NPS youth population can be accessed through analysis of data collected for the study titled Profile of American Youth. As part of that study, a national sample of 12,000 youth aged 16 to 23 years was given the Armed Services Vocational Aptitude Battery, the test that is used to qualify individuals for military service. In this study, it was shown that data from the Profile of American Youth could be used to determine the percent of NPS youth in various demographic groups who qualify for military service.[6/] The qualification rates can be derived for seven aggregate classes of aptitudes:

- General,
- Administrative/Clerical,
- Technical,
- Mechanical,
- Mechanical Maintenance,
- Combat, and
- Field.

Those qualification rates can then be used to project the aptitude content of the NPS youth population.

6/ It should be noted, however, that this study only uses a portion of the military's qualification standards in assessing the youth population. In particular, this study does not reflect the possibility that some NPS youth do not qualify for military service for other than lack of aptitude. In fact, many individuals do not qualify for medical reasons or because of their criminal records.

The aptitude content of the NPS youth population can be used as the basis for analyzing the adequacy of current and proposed DoD policies to regulate accession into the military and retain already enlisted military personnel. The supply projection model developed in this study is one that can readily incorporate changing values (annually if appropriate) for such policy variables as accession rates, retention rates, and promotion rates. That will enable an assessment of the value of proposed policies to adequately maintain desired force sizes and aptitude content in the enlisted force in spite of a decrease in the size of the youth population.

In addition, the analyses discussed above can be used to help maximize the effectiveness of, for instance, recruiting policy. The implications of the demographic analysis suggest that selected targeting of certain regions of the country for particular skills may be desirable.

In many respects, the analysis outlined in this study presents a worst-case projection. The projections presented here assume that there will not be significant changes in the education system in the U.S., in accession and retention rates, and in the general policies which govern the All-Volunteer Force.

In April 1983, the National Commission on Excellence in Education (NCEE) reported that the U.S. was "at risk" from "a rising tide of mediocrity" instigated by poor standards in (principally) secondary education. One important indicator of the decline in proficiency among the nation's youth was the

decrease in SAT (Scholastic Aptitude Test) scores. In particular, average scores on the verbal portion of the SATs dropped more than 50 points from 1963 to 1980. Average scores on the math portion dropped almost 40 points.

Among the findings of the NCEE are the following:

- approximately 13 percent of all 17 year olds in the U.S. are functionally illiterate;
- functional illiteracy among minority youth may be as high as 40 percent; and
- high school students today are achieving lower scores on most standardized tests than students did 26 years ago.

In testimony before the Commission, the Navy reported that one-fourth of its recruits cannot read at the ninth grade level. That proficiency is the least needed to understand printed safety instructions. Expensive remedial work is required in order to enable many recruits to complete the sophisticated training required.

The NCEE recommended five actions that, if implemented, may help improve the proficiency of the nation's youth. However, although it is true that all but a few states have convened task forces to look into school reform, no quantitative evidence exists to support a hypothesis of improved aptitude in the youth population during the next 10 years, and perhaps during the next 20 years.

Hopefully, given the information presented here, and the analytical framework developed in this study, effective policies can be found to alleviate the effects of the declining U.S. youth population and the recent decreases in the aptitudes of 17 to 21 year olds.

APPENDIX A

PROMANSA MODEL DOCUMENTATION

OVERVIEW OF PROMANSA MODEL CALCULATIONS

The PROMANSA Model, described in Section II of this report, is a Markov transition model which time-steps groups of individuals on an annual basis provides the analytical framework of the methodology. The assumptions associated with the Markov process have been incorporated into the model. They are briefly outlined below. First, it is assumed that the probabilities associated with each individual or groups of individuals do not vary over the given time period. Second, individuals move independently of each other. For example, if one person is recruited, this has no effect on the probability of another being recruited. Third, individuals must either remain at their current position in the matrix, move to a new position, or leave the matrix. All of these characteristics are considered throughout the model.

The model itself provides the basic methodology for the force structure projections. To remain consistent with the overall goal of the task, the primary input data used consists of the estimated population of 16 year olds from 1982 to 2010, and the 1982 population of 17 to 21 year old civilian non-institutional youth. Prior to describing the operation of the model, three of its principal components must be defined. The civilian sector is composed of both prior and non-prior service (NPS) youths. In keeping with the accepted military definition, apprentices are classified as those individuals with one to four years of military service. To insure consistency, journeymen

are defined as those individuals with five or more years of service. For purposes of clarity, only NPS youth will initially be discussed.

The NPS youth data is a derived set of numbers. It is formed by subtracting out the number of persons, by age group, in 1982 from the total age-specific youth population of the same year. These values form the top horizontal vector of a matrix (Exhibit A-1). The first vertical vector of the matrix is derived from given official Bureau of the Census data for the number of 16-year-olds from 1982 to 2010. For the purposes of this model, it is assumed that all 16-year-olds have no prior military service. Furthermore, it is assumed tht all 16-year-olds will become 17-year-olds in the following year.

The remainder of the matrix is calculated in the following manner. The youth cohort 17 to 21 years of age, for each subsequent year, face two options: to remain in the civilian sector or access into the military. To determine the number of youths who remain in the civilian sectory, by age, by year, an age-specific continuation rate (calculated as 1-accession rate) is used. This rate is applied to the former NPS youth population of the former age of the former year. For example, to obtain the 19-year-old NPS youth population of 1985, the 18-year-old NPS youth population of 1984 is multiplied by 1-(1984, 18-year-old accession rate). The entire matrix is calculated in this manner.

Given that this NPS is now completed and annual accession rates are available, one may now apply these accession rates to

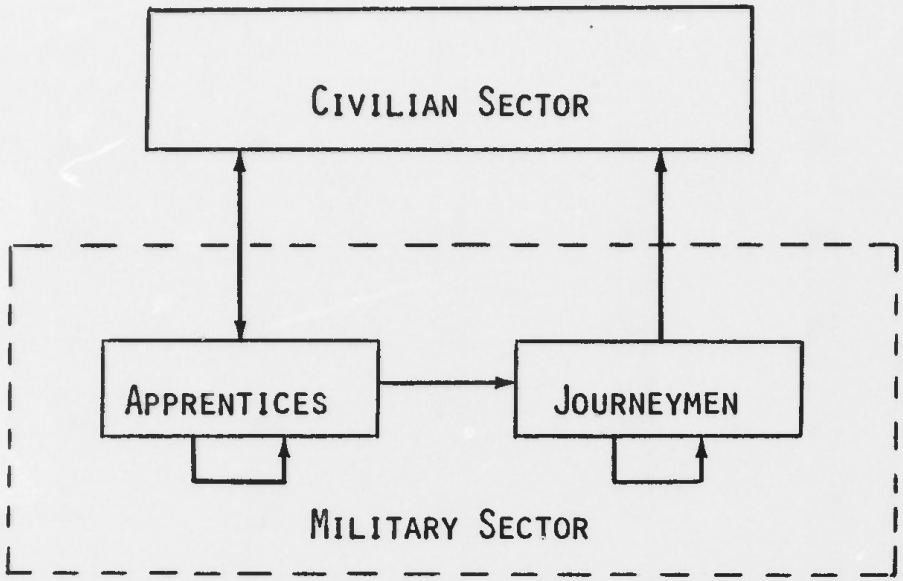

Exhibit A-1. PROMANSA FORCE STRUCTURE MODEL

the various age cohorts and progress through the model. Once a person is accessed into the military, he/she enters into the apprentice classification. During the course of the apprenticeship, an individual faces three options: first, to return to the civilian sector which is referred to as the apprentice exit rate; second, to continue on as an apprentice, known as the apprentice continuation rate; or third, to move into the journeymen sector, referred to as the graduation rate. For each of these options, service and DoD-specific rates have been annually calculated. The initial calculations were based on the FY80 rates provided by the Defense Manpower Data Center (DMDC). After the derivation of the continuation rates, the associated exit rates may be calculated as 1-continuation rate for any year or service.

Journeymen/supervisors similar to their apprentice counterparts face two options, to continue as journeymen/supervisors or return to the civilian sector. In addition, a parallel set of definitions apply regarding the journeymen/supervisor continuation and exit rates. Again, both are calculated on an annual basis and are service-DoD specific.

The annual totals of the numbers of accessions, apprentices and journeymen/supervisors are produced as a result of this calculation.

In keeping with the overall goal of the task, the apprentices are classified into the seven aptitude clusters developed by MCR and the 26 Service composites. The data used for this classification was obtained from the FY81 and FY82 military accession

file maintained by DMDC. Again, only NPS individuals were considered. From these files cluster and composite qualification rates were developed based upon the required minimum sum of the standard scores on the various combinations of the Armed Services Vocational Aptitude Battery (ASVAB) subtests. The scores have been standardized based upon the conversions in the validated table "ASVAB 8-9-10 Conversions of Raw Test Scores to Standard Scores." This was done to insure cross-service applicability of the methodology. Depending upon the minimum score achieved an individual may qualify for more than one of the seven aptitude clusters.

In addition to the processes occurring within each component, there is also interaction between the various components. This results in a continous flow process between each of the three sectors. The civilian sector is composed of civilians who remain civilians plus the apprentices and journeymen who exit their respective sectors minus the new civilian accessions. The apprentices are composed of the continuing apprentices plus the new apprentices from the civilian sector, minus those apprentices who exit to become journeymen and return to the civilian sector. Lastly, the journeymen sector is comprised of the continuing journeymen plus the apprentices who become journeymen minus the journeymen who return to the civilian sector.

After the initial apprentice cluster classification, the analysis is expanded to incorporate the civilian sector population with respect to age. This enables a cross-sectional view

of the civilian youth population through the 1982 to 2010 time frame. In addition, it also provides a comparison of the civilian youth population with its military counterparts. The database for this portion of the analysis has been derived from the computer records of the 1980 OASD (MRA&L) study, The Profile of American Youth. Again, only the appropriate 17 to 21 year old cohort was extracted from the file.

```
100  PRINT  CHR$ (4)"BRUN AMPER INTERPRETER"
110 F$ = "FRMT,X15,S;":T$ = "FRMT,$15;"
120 G$ = "FRMT,X15,S;"
130  READ S(1),S(2),S(3),S(4),S(5)
140  DATA  .12,.40,.25,.14,.09
150  FOR I = 1 TO 5: READ T$(I): NEXT : FOR I = 1 TO 5: READ U$(I): NEXT
160  DATA YEAR,ACC,APPR,JRNY,TOTAL,----,---,----,----,-----
170  FOR I = 1 TO 8: READ TZ$(I): NEXT
180  DATA "YEAR","CLUSTER 1","CLUSTER 2","CLUSTER 3","CLUSTER 4","CLUSTER
     5","CLUSTER 6","CLUSTER 7"
190  FOR I = 1 TO 8: READ TX$(I): NEXT
200  DATA "-----","----------","----------","----------","----------","--------
     -","----------","----------"
210  DIM P1(50),P3(50),P4(50),A(6,29),X1(50),X2(50),YEAR(50),SUM(50),ACC(5
     0)
220  DIM R1(7,29),R2(7,29),R3(7,29),R4(7,29),R5(7,29)
230  DIM C(5,7,29)
240  PRINT "DAISY WHEEL (Y/N)";
250  GET A$: IF A$ <  > "Y" AND A$ <  > "N" THEN 250
260  PRINT :DY$ = "N": IF A$ = "Y" THEN DY$ = "Y"
270  PRINT  CHR$ (4)"PR#1": PRINT  CHR$ (9)"132N": IF DY$ = "Y" THEN  PRINT
      CHR$ (27)"ED8": GOTO 290
280  PRINT  CHR$ (31)
290  REM
300 CU = 1
310  REM  READ CONTINUATION RATES
320  READ BY,EY
330  READ YEAR(1),P1(1),P3(1),P4(1)
340  FOR J = 2 TO (EY - BY + 1):YEAR(J) = YEAR(1):P1(J) = P1(1):P3(J) = P3
     (1):P4(J) = P4(1): NEXT
350  REM  NPS ACCESSION CALCULATION
360  READ X1(1),X2(1)
370  DIM P(5)
380  READ P(1),P(2),P(3),P(4),P(5)
390  FOR I = 1 TO 6: READ A(I,1): NEXT : FOR J = 2 TO 29: READ A(1,J): NEXT

400  FOR J = 2 TO 29
410 A(2,J) = A(1,J - 1)
420  NEXT J
430 J = 2
440 I = 3
450 A(I,J) = (1 - P(I - 2)) * A(I - 1,J - 1)
460 I = I + 1
470  IF I < 7 GOTO 450
480 J = J + 1
490  IF J < 30 GOTO 440
500  PRINT "                                                    NPS YOUTH POPULAT
     ION"
510  PRINT
515  PRINT "                                                   (NUMBERS IN THOUSA
     NDS)": PRINT
520  PRINT "                    ----------------------------------------AGE------
     ---------------------------------"
530  PRINT : PRINT
540  PRINT "YEAR              16                17                18                1
     9                20                21"
550  PRINT "----              --                --                --                -
     -                --                --"
```

```
560  PRINT
570  FOR J = 1 TO 29
580  PRINT 1981 + J;
590  FOR K = 1 TO 6
600  & PRNT,A(K,J) / 1000,F$
610  NEXT K: PRINT : NEXT J
620 SUM(1) = X1(1) + X2(1)
630 ACC(1) = 0
640 J = 1
650 ACC(J) = P(1) * A(2,J) + P(2) * A(3,J) + P(3) * A(4,J) + P(4) * A(5,J)
      + P(5) * A(6,J)
660 J = J + 1
670  IF J < 30 GOTO 650
680 J = 2
690 X1(J) = ACC(J) + X1(J - 1) - P1(J) * X1(J - 1) - P3(J) * X1(J - 1)
700 X2(J) = X2(J - 1) - P4(J) * X2(J - 1) + P3(J) * X1(J - 1)
710 SUM(J) = X1(J) + X2(J)
720 J = J + 1
730  IF J < 30 GOTO 690
740  PRINT  CHR$ (12)
750  PRINT "             NUMBER OF ACCESSIONS, APPRENTICES & JOURNEYMEN FROM
      1982 TO 2010"
760  PRINT
765  PRINT "                                        (NUMBERS IN THOUSANDS)": PRINT

770  FOR I = 1 TO 5: POKE 32,(I - 1) * 13: & PRNT,T$(I),T$: NEXT : PRINT :
      FOR I = 1 TO 5: POKE 32,(I - 1) * 13: & PRNT,U$(I),T$: NEXT : PRINT

780  PRINT
790 N = 1
800  POKE 32,0: & PRNT,YEAR(1) + (N - 1),G$: POKE 32,15: & PRNT,ACC(N) / 1
     000,F$: POKE 32,30: & PRNT,X1(N) / 1000,F$: POKE 32,45: & PRNT,X2(N) /
     1000,F$: POKE 32,60: & PRNT,SUM(N) / 1000,F$: PRINT
810 N = N + 1
820  IF N < EY - BY + 2 THEN  GOTO 800
830  REM  CALCULATION OF CLUSTER CLASSIFICATION
840 Q = 1
850 CU = 1
860  READ R1(1,1),R1(2,1),R1(3,1),R1(4,1),R1(5,1),R1(6,1),R1(7,1)
870  FOR J = 2 TO 29:R1(1,J) = R1(1,1):R1(2,J) = R1(2,1):R1(3,J) = R1(3,1)
     :R1(4,J) = R1(4,1):R1(5,J) = R1(5,1):R1(6,J) = R1(6,1):R1(7,J) = R1(7
     ,1): NEXT
880  READ R2(1,1),R2(2,1),R2(3,1),R2(4,1),R2(5,1),R2(6,1),R2(7,1)
890  FOR J = 2 TO 29:R2(1,J) = R2(1,1):R2(2,J) = R2(2,1):R2(3,J) = R2(3,1)
     :R2(4,J) = R2(4,1):R2(5,J) = R2(5,1):R2(6,J) = R2(6,1):R2(7,J) = R2(7
     ,1): NEXT
900  READ R3(1,1),R3(2,1),R3(3,1),R3(4,1),R3(5,1),R3(6,1),R3(7,1)
910  FOR J = 2 TO 29:R3(1,J) = R3(1,1):R3(2,J) = R3(2,1):R3(3,J) = R3(3,1)
     :R3(4,J) = R3(4,1):R3(5,J) = R3(5,1):R3(6,J) = R3(6,1):R3(7,J) = R3(7
     ,1): NEXT
920  READ R4(1,1),R4(2,1),R4(3,1),R4(4,1),R4(5,1),R4(6,1),R4(7,1)
930  FOR J = 2 TO 29:R4(1,J) = R4(1,1):R4(2,J) = R4(2,1):R4(3,J) = R4(3,1)
     :R4(4,J) = R4(4,1):R4(5,J) = R4(5,1):R4(6,J) = R4(6,1):R4(7,J) = R4(7
     ,1): NEXT
940  READ R5(1,1),R5(2,1),R5(3,1),R5(4,1),R5(5,1),R5(6,1),R5(7,1)
950  FOR J = 2 TO 29:R5(1,J) = R5(1,1):R5(2,J) = R5(2,1):R5(3,J) = R5(3,1)
     :R5(4,J) = R5(4,1):R5(5,J) = R5(5,1):R5(6,J) = R5(6,1):R5(7,J) = R5(7
     ,1): NEXT
```

```
960  FOR I = 1 TO 7
970  FOR J = 1 TO 29
980  IF Q = 2 GOTO 1070
990  IF Q = 3 GOTO 1070
1000  IF Q = 5 GOTO 1070
1010 C(1,I,J) = R1(I,J) * A(2,J)
1020 C(2,I,J) = R2(I,J) * A(3,J)
1030 C(3,I,J) = R3(I,J) * A(4,J)
1040 C(4,I,J) = R4(I,J) * A(5,J)
1050 C(5,I,J) = R5(I,J) * A(6,J)
1060  GOTO 1120
1070 C(1,I,J) = R1(I,J) * S(1) * X1(J)
1080 C(2,I,J) = R2(I,J) * S(2) * X1(J)
1090 C(3,I,J) = R3(I,J) * S(3) * X1(J)
1100 C(4,I,J) = R4(I,J) * S(4) * X1(J)
1110 C(5,I,J) = R5(I,J) * S(5) * X1(J)
1120  NEXT J: NEXT I
1130  FOR L = 1 TO 5
1140  PRINT  CHR$ (12)
1150  IF Q = 1 GOTO 1220
1160  IF Q = 2 GOTO 1200
1170  IF Q = 3 GOTO 1200
1180  IF Q = 4 GOTO 1430
1190  IF Q = 5 GOTO 1510
1200  PRINT "                    NUMBER OF ";16 + L" YEAR OLO MILITARY YOUTH
      S IN CLUSTER GROUP ";CU" FROM 1982 TO 2010 (FY ";79 + Q" DATA)"
1210  GOTO 1230
1220  PRINT "                          NUMBER OF ";16 + L" YEAR OLD NPS CIVIL
      IANS IN CLUSTER GROUP ";CU" FROM 1982 TO 2010
      "
1230  PRINT
1235  PRINT "                                                    (NUMBERS IN T
      HOUSANOS)": PRINT
1240  PRINT "               ----------------------------------------COMPOSI
      TES----------------------------------------"
1250  PRINT : PRINT
1260  IF CU = 1 GOTO 1300
1270  IF CU = 2 GOTO 1320
1280  IF CU = 3 GOTO 1340
1290  IF CU = 4 GOTO 1360
1300  PRINT "YEAR          NVGB          NVGE          MCGT
      AFG           ARCL          NVCL          MCCL"
1310  GOTO 1400
1320  PRINT "YEAR          AFCL          AREL          NVEL          M
      CEL           AFEL          ARGM          ARST"
1330  GOTO 1400
1340  PRINT "YEAR          NVST          MCFA          NVNC          A
      FME           NVMT          ARMM          MCMM"
1350  GOTO 1400
1360  PRINT "YEAR          ARFA          ARCO          MCCO          A
      ROF           ARSC          ****          ****"
1370  GOTO 1380
1380  PRINT "----          ----          ----          ----          -
      ---           ----          ----          ----"
1390  GOTO 1410
1400  PRINT "----          ----          ----          ----          -
      ---           ----          ----          ----"
1410  PRINT
1420  GOTO 1590
```

```
1430  PRINT "                                NUMBER OF ";16 + L" YEAR OLO NPS CIVIL
      IANS IN MCR APTITUOE CLUSTERS FROM 1982 TO 2010"
1440  PRINT : PRINT
1445  PRINT "                                                              (NUMBERS I
      N THOUSANOS)": PRINT
1450  PRINT "                    ----------------------------------------APTITUOE
      CLUSTERS----------------------------------------"
1460  PRINT : PRINT
1470  PRINT "YEAR                GEN              AOCL              TECH              M
      ECH              MEMT              CMBT              FIELO"
1480  PRINT "----              ----              ----              ----              -
      ---              ----              ----              ----"
1490 CU = 4
1500  GOTO 1590
1510  PRINT "                    NUMBER OF ";16 + L" YEAR OLO MILITARY YOUTHS
      IN MCR APTITUDE CLUSTERS FROM 1982 TO 2010 (FY82 OATA)"
1520  PRINT
1525  PRINT "                                                              (NUMBERS I
      N THOUSANOS)": PRINT
1530  PRINT "                    ----------------------------------------APTITUOE
      CLUSTERS----------------------------------------"
1540  PRINT : PRINT
1550  PRINT "YEAR                GEN              ADCL              TECH              M
      ECH              MEMT              CMBT              FIELD"
1560  PRINT "----              ----              ----              ----              -
      ---              ----              ----              ----"
1570 CU = 4
1580  GOTO 1590
1590  FOR J = 1 TO 29
1600  PRINT 1981 + J;
1610  FOR K = 1 TO 7
1620  & PRNT,C(L,K,J) / 1000,F$
1630  NEXT K: PRINT : NEXT J
1640  NEXT L
1650 CU = CU + 1
1660  IF CU < 5 GOTO 860
1670 Q = Q + 1
1690  IF Q < 6 GOTO 850
1700  REM  BASE YR,LAST YR OF PROJECTION PERIOD
1710  OATA 1982,2010
1720  REM  APP. EXIT RATE,GRAO. RATE OF APP. TO JOUR.,J/S EXIT RATE ::: AL
      L ARE BY YEAR,OOD
1730  DATA 1982,.216,.109,.124
1740  REM  APP. EXIT RATE,GRAO. RATE OF APP. TO JOUR.,J/S EXIT RATE ::::AL
      L ARE BY YEAR,ARMY
1750  REM  OATA1982,.225,.111,.118
1760  REM  BASE NUMBER OF APP. ,J/S IN YEAR 1
1770  OATA 1059932,680328
1780  REM  ACC RATES BY AGE FOR FY1982
1790  DATA .0053,.0190,.0129,.0075,.0049
1800  REM  NPS YOUTH POPULATION (16 YRS OLO IN 1982,17 YRS OLD IN 1982....
      21 YRS OLO IN 1982)
1810  OATA 3661000,3888000,4087000,4185000,4326000,4277000
1820  REM  NPS YOUTH POPULATION ( 16 YRS OLD IN 1983,16 YRS OLD IN 1984...
      .16 YRS OLO IN 2010 )
1830  DATA 3561000,3480000,3526000,3611000,3691000,3386000,3202000,3129000
      ,3207000,3160000,3222000,3318000,3450000,3609000,3763000,3866000,3931
      000,3977000,3989000,4001000,4013000,4025000,4037000,4002000,3966000,3
      930000,3895000,3860000
```

```
1840  REM  ****** PAY CIVILIAN DATA ******
1850  REM  DATA FOR THE PROPORTION OF 17 YEAR OLOS IN 1ST CLUSTER GROUP BY
      YEAR
1860  DATA .647,.214,.616,.693,.653,.504,.736
1870  REM 18 YEAR OLOS
1880  DATA .695,.240,.662,.743,.718,.574,.787
1890  REM 19 YEAR OLOS
1900  DATA .704,.186,.681,.753,.721,.593,.777
1910  REM 20 YEAR OLOS
1920  DATA .732,.304,.704,.767,.742,.619,.795
1930  REM 21 YEAR OLOS
1940  DATA .759,.402,.730,.794,.765,.644,.830
1950  REM ****
1960  REM  DATA FOR THE PROPORTION OF 17 YEAR OLOS IN 2ND CLUSTER GROUP BY
      YEAR
1970  DATA .607,.638,.310,.585,.593,.594,.651
1980  REM 18 YEAR OLOS
1990  DATA .670,.691,.332,.623,.633,.642,.696
2000  REM 19 YEAR OLOS
2010  DATA .697,.706,.354,.635,.643,.673,.712
2020  REM 20 YEAR OLOS
2030  DATA .696,.729,.386,.672,.684,.707,.724
2040  REM 21 YEAR OLOS
2050  DATA .722,.760,.418,.704,.715,.725,.756
2060  REM  DATA FOR THE PROPORTION OF 17 YEAR OLOS IN 3RD CLUSTER GROUP BY
      YEAR
2070  DATA .466,.558,.191,.088,.400,.517,.641
2080  REM 18 YEAR OLOS
2090  DATA .521,.631,.216,.106,.468,.568,.692
2100  REM 19 YEAR OLOS
2110  DATA .549,.630,.239,.123,.503,.600,.728
2120  REM 20 YEAR OLOS
2130  DATA .591,.664,.276,.158,.559,.653,.745
2140  REM 21 YEAR OLOS
2150  DATA .617,.690,.328,.198,.575,.649,.768
2160  REM  DATA FOR THE PROPORTION OF 17 YEAR OLOS IN 4TH CLUSTER GROUP BY
      YEAR
2170  DATA  .683,.619,.672,.595,.528,.000,.000
2180  REM 18 YEAR OLOS
2190  DATA  .728,.664,.734,.673,.620,.000,.000
2200  REM 19 YEAR OLOS
2210  DATA  .714,.682,.748,.681,.643,.000,.000
2220  REM 20 YEAR OLOS
2230  DATA  .749,.721,.760,.704,.687,.000,.000
2240  REM 21 YEAR OLOS
2250  DATA  .752,.728,.790,.727,.702,.000,.000
2270  REM  ****** FY81 MILITARY DATA ******
2280  REM  DATA FOR THE PROPORTION OF 17 YEAR OLOS IN 1ST CLUSTER GROUP BY
      YEAR
2290  DATA .952,.086,.931,.992,.877,.756,.967
2300  REM 18 YEAR OLOS
2310  DATA .897,.143,.889,.990,.845,.746,.971
2320  REM 19 YEAR OLOS
2330  DATA .878,.158,.872,.987,.826,.732,.961
2340  REM 20 YEAR OLOS
2350  DATA .902,.248,.887,.990,.837,.759,.963
2360  REM 21 YEAR OLOS
2370  DATA .916,.313,.898,.990,.851,.776,.967
```

```
2380  REM DATA FOR THE PROPORTION OF 17 YEAR OLOS IN 2NO CLUSTER GROUP BY
      YEAR
2390  OATA .928,.845,.417,.893,.963,.772,.790
2400  REM 18 YEAR OLOS
2410  OATA .912,.778,.450,.865,.945,.723,.720
2420  REM 19 YEAR OLOS
2430  OATA .904,.757,.423,.855,.945,.714,.698
2440  REM 20 YEAR OLDS
2450  OATA .913,.787,.475,.859,.945,.758,.731
2460  REM 21 YEAR OLOS
2470  OATA .921,.806,.490,.879,.949,.770,.748
2480  REM  DATA FOR THE PROPORTIDN OF 17 YEAR OLDS IN 3RO CLUSTER GROUP BY
      YEAR
2490  DATA .798,.895,.200,.203,.732,.761,.957
2500  REM 18 YEAR OLOS
2510  DATA .739,.853,.246,.206,.709,.689,.950
2520  REM 19 YEAR OLOS
2530  DATA .711,.836,.247,.237,.702,.683,.948
2540  REM 20 YEAR OLOS
255D  OATA .751,.851,.301,.265,.741,.723,.952
2560  REM 21 YEAR OLOS
2570  OATA .758,.872,.325,.295,.748,.741,.955
2580  REM  OATA FOR THE PROPORTION OF 17 YEAR OLOS IN 4TH CLUSTER GROUP BY
      YEAR
2590  DATA .907,.865,.969,.845,.745,.000,.000
2600  REM 18 YEAR OLOS
2610  DATA .867,.816,.968,.777,.702,.000,.000
2620  REM 19 YEAR OLDS
2630  OATA .845,.804,.963,.760,.677,.000,.000
2640  REM 20 YEAR OLOS
2650  OATA .848,.824,.972,.792,.712,.000,.D00
2660  REM 21 YEAR OLOS
2670  DATA .856,.840,.971,.801,.746,.000,.000
2680  REM  ****** FY82 MILITARY OATA ******
2690  REM  OATA FOR THE PROPORTION OF 17 YEAR OLOS IN 1ST CLUSTER GROUP BY
      YEAR
270D  OATA  .930,.074,.947,.902,.926,.740,.971
2710  REM 18 YEAR OLOS
272D  OATA  .882,.095,.925,.847,.913,.737,.954
2730  REM 19 YEAR OLDS
2740  OATA  .860,.126,.922,.823,.900,.710,.947
2750  REM 20 YEAR OLOS
2760  DATA  .882,.194,.934,.849,.908,.750,.957
2770  REM 21 YEAR OLDS
2780  OATA  .899,.229,.940,.869,.916,.767,.963
2790  REM  OATA FOR THE PROPORTION OF 17 YEAR OLDS IN 2NO CLUSTER GRDUP BY
      YEAR
2800  OATA  .976,.931,.393,.961,.871,.875,.90D
2810  REM 18 YEAR OLOS
2820  DATA  .967,.907,.405,.925,.838,.854,.872
2830  REM 19 YEAR OLOS
2840  OATA  .958,.891,.388,.906,.817,.845,.854
285D  REM 20 YEAR OLOS
2860  OATA  .962,.907,.438,.922,.839,.869,.873
2870  REM 21 YEAR OLOS
2880  OATA  .964,.917,.463,.933,.857,.882,.884
2890  REM OATA FOR THE PROPORTION OF 17 YEAR OLDS IN 3RD CLUSTER GROUP BY
      YEAR
```

```
2900  DATA  .745,.875,.195,.859,.686,.856,.882
2910  REM 18 YEAR OLDS
2920  DATA  .693,.862,.213,.810,.659,.824,.848
2930  REM 19 YEAR OLDS
2940  DATA  .669,.841,.215,.789,.660,.817,.829
2950  REM 20 YEAR OLOS
2960  DATA  .714,.860,.268,.816,.706,.843,.850
2970  REM 21 YEAR OLDS
2980  DATA  .736,.873,.300,.832,.728,.857,.867
2990  REM DATA FOR THE PROPORTION OF 17 YEAR OLDS IN 4TH CLUSTER GROUP BY
     YEAR
3000  DATA  .952,.929,.139,.925,.848,.000,.000
3010  REM 18 YEAR OLDS
3020  DATA  .938,.909,.162,.900,.833,.000,.000
3030  REM 19 YEAR OLDS
3040  DATA  .921,.900,.180,.889,.816,.000,.000
3050  REM 20 YEAR OLDS
3060  DATA  .931,.918,.224,.908,.845,.000,.000
3070  REM 21 YEAR OLDS
3080  DATA  .933,.921,.249,.914,.863,.000,.000
3090  REM  ****** PAY CIVILIAN DATA BY APTITUDE CLUSTER :::: ALL ARE BY YE
     AR ******
3100  REM  DATA FOR THE PROPORTION OF 17 YEAR OLDS IN MCR APTITUDE CLUSTER
     S
3110  DATA .693,.736,.694,.401,.641,.703,.680
3120  REM 18 YEAR OLDS
3130  DATA .743,.787,.749,.468,.692,.750,.740
3140  REM 19 YEAR OLDS
3150  DATA .753,.777,.758,.503,.728,.741,.752
3160  REM 20 YEAR OLDS
3170  DATA .767,.795,.773,.559,.745,.767,.768
3180  REM 21 YEAR OLDS
3190  DATA .794,.830,.800,.575,.768,.777,.794
3200  REM  ****** FY82 MILITARY DATA BY APTITUDE CLUSTER :::: ALL ARE BY Y
     EAR ******
3210  REM  DATA FOR THE PROPORTION OF 17 YEAR OLDS IN MCR APTITUDE CLUSTER
     S
3220  DATA  .902,.971,.989,.869,.882,.968,.943
3230  REM 18 YEAR OLDS
3240  DATA  .847,.954,.983,.825,.848,.956,.923
3250  REM 19 YEAR OLDS
3260  DATA  .823,.947,.977,.809,.829,.947,.912
3270  REM 20 YEAR OLDS
3280  DATA  .849,.957,.982,.836,.850,.956,.927
3290  REM 21 YEAR OLDS
3300  DATA  .869,.963,.985,.850,.867,.958,.935
3310  POKE 32,0: PRINT  CHR$ (12): PRINT  CHR$ (4)"PR#0": END
```

APPENDIX B

EXAMPLES OF PROMANSA MODEL OUTPUT

YEAR	ACC	APPR	JRNY	TOTAL
1982	206	1060	680	1740
1983	197	912	711	1624
1984	187	802	723	1525
1985	179	721	721	1441
1986	174	660	710	1370
1987	172	618	694	1312
1988	174	591	675	1266
1989	175	574	656	1230
1990	170	558	637	1195
1991	163	540	619	1159
1992	158	522	601	1123
1993	156	508	583	1092
1994	155	498	566	1064
1995	156	492	550	1043
1996	159	492	536	1028
1997	164	496	523	1019
1998	171	505	512	1018
1999	178	519	504	1022
2000	183	534	498	1031
2001	188	548	494	1043
2002	191	561	493	1054
2003	193	572	493	1065
2004	194	580	494	1075
2005	195	587	496	1083
2006	196	592	499	1090
2007	196	595	501	1096
2008	195	597	504	1101
2009	194	597	507	1104
2010	193	596	509	1105

Note: Data in thousands

Exhibit B-1. PROMANSA DEMONSTRATION ESTIMATE OF THE NUMBER OF ACCESSIONS, APPRENTICES & JOURNEYMEN FROM 1982 TO 2010

NUMBER OF 17 YEAR OLD NPS CIVILIANS IN CLUSTER GROUP 1 FROM 1982 TO 2010

(NUMBERS IN THOUSANDS)

	COMPOSITES						
YEAR	NVGB	NVGE	MCGT	AFG	ARCL	NVCL	MCCL
1982	2516	832	2395	2694	2539	1960	2862
1983	2369	783	2255	2537	2391	1845	2694
1984	2304	762	2194	2468	2325	1795	2621
1985	2252	745	2144	2412	2272	1754	2561
1986	2281	755	2172	2444	2302	1777	2595
1987	2336	773	2224	2502	2358	1820	2658
1988	2388	790	2274	2558	2410	1860	2717
1989	2191	725	2086	2346	2211	1707	2492
1990	2072	685	1972	2219	2091	1614	2357
1991	2024	670	1927	2168	2043	1577	2303
1992	2075	686	1976	2222	2094	1616	2360
1993	2045	676	1947	2190	2063	1593	2326
1994	2085	690	1985	2233	2104	1624	2371
1995	2147	710	2044	2299	2167	1672	2442
1996	2232	738	2125	2391	2253	1739	2539
1997	2335	772	2223	2501	2357	1819	2656
1998	2435	805	2318	2608	2457	1897	2770
1999	2501	827	2381	2679	2524	1948	2845
2000	2543	841	2421	2724	2567	1981	2893
2001	2573	851	2450	2756	2597	2004	2927
2002	2581	854	2457	2764	2605	2010	2936
2003	2589	856	2465	2773	2613	2017	2945
2004	2596	859	2472	2781	2620	2023	2954
2005	2604	861	2479	2789	2628	2029	2962
2006	2612	864	2487	2798	2636	2035	2971
2007	2589	856	2465	2773	2613	2017	2945
2008	2566	849	2443	2748	2590	1999	2919
2009	2543	841	2421	2723	2566	1981	2892
2010	2520	834	2399	2699	2543	1963	2867

NUMBER OF 17 YEAR OLD MILITARY YOUTHS IN CLUSTER GROUP 1 FROM 1982 TO 2010 (FY 82 DATA)

(NUMBERS IN THOUSANDS)

	COMPOSITES						
YEAR	NVGB	NVGE	MCGT	AFG	ARCL	NVCL	MCCL
1982	118	9	120	115	118	94	124
1983	102	8	104	99	101	81	106
1984	90	7	91	87	89	71	93
1985	80	6	82	78	80	64	84
1986	74	6	75	71	73	59	77
1987	69	5	70	67	69	55	72
1988	66	5	67	64	66	53	69
1989	64	5	65	62	64	51	67
1990	62	5	63	60	62	50	65
1991	60	5	61	58	60	48	63
1992	58	5	59	57	58	46	61
1993	57	5	58	55	56	45	59
1994	56	4	57	54	55	44	58
1995	55	4	56	53	55	44	57
1996	55	4	56	53	55	44	57
1997	55	4	56	54	55	44	58
1998	56	4	57	55	56	45	59
1999	58	5	59	56	58	46	60
2000	60	5	61	58	59	47	62
2001	61	5	62	59	61	49	64
2002	63	5	64	61	62	50	65
2003	64	5	65	62	64	51	67
2004	65	5	66	63	64	52	68
2005	65	5	67	64	65	52	68
2006	66	5	67	64	66	53	69
2007	66	5	68	64	66	53	69
2008	67	5	68	65	66	53	70
2009	67	5	68	65	66	53	70
2010	66	5	68	64	66	53	69

NUMBER OF 17 YEAR OLD NPS CIVILIANS IN MCR APTITUDE CLUSTERS FROM 1982 TO 2010

(NUMBERS IN THOUSANDS)

	APTITUDE CLUSTERS						
YEAR	GEN	ADCL	TECH	MECH	MEMT	CMBT	FIELD
1982	2694	2862	2698	1559	2492	2733	2644
1983	2537	2694	2541	1468	2347	2574	2489
1984	2468	2621	2471	1428	2283	2503	2421
1985	2412	2561	2415	1395	2231	2446	2366
1986	2444	2595	2447	1414	2260	2479	2398
1987	2502	2658	2506	1448	2315	2539	2455
1988	2558	2717	2562	1480	2366	2595	2510
1989	2346	2492	2350	1358	2170	2380	2302
1990	2219	2357	2222	1284	2052	2251	2177
1991	2168	2303	2172	1255	2006	2200	2128
1992	2222	2360	2226	1286	2056	2255	2181
1993	2190	2326	2193	1267	2026	2221	2149
1994	2233	2371	2236	1292	2065	2265	2191
1995	2299	2442	2303	1331	2127	2333	2256
1996	2391	2539	2394	1383	2211	2425	2346
1997	2501	2656	2505	1447	2313	2537	2454
1998	2608	2770	2612	1509	2412	2645	2559
1999	2679	2845	2683	1550	2478	2718	2629
2000	2724	2893	2728	1576	2520	2763	2673
2001	2756	2927	2760	1595	2549	2796	2704
2002	2764	2936	2768	1600	2557	2804	2713
2003	2773	2945	2777	1604	2565	2813	2721
2004	2781	2954	2785	1609	2572	2821	2729
2005	2789	2962	2793	1614	2580	2830	2737
2006	2798	2971	2802	1619	2588	2838	2745
2007	2773	2945	2777	1605	2565	2813	2721
2008	2748	2919	2752	1590	2542	2788	2697
2009	2723	2892	2727	1576	2519	2763	2672
2010	2699	2867	2703	1562	2497	2738	2649

NUMBER OF 17 YEAR OLD MILITARY YOUTHS IN MCR APTITUDE CLUSTERS FROM 1982 TO 2010 (FY82 DATA)

(NUMBERS IN THOUSANDS)

YEAR	APTITUDE CLUSTERS						
	GEN	ADCL	TECH	MECH	MEMT	CMBT	FIELD
1982	115	124	126	111	112	123	120
1983	99	106	108	95	97	106	103
1984	87	93	95	84	85	93	91
1985	78	84	86	75	76	84	82
1986	71	77	78	69	70	77	75
1987	67	72	73	64	65	72	70
1988	64	69	70	62	63	69	67
1989	62	67	68	60	61	67	65
1990	60	65	66	58	59	65	63
1991	58	63	64	56	57	63	61
1992	57	61	62	54	55	61	59
1993	55	59	60	53	54	59	58
1994	54	58	59	52	53	58	56
1995	53	57	58	51	52	57	56
1996	53	57	58	51	52	57	56
1997	54	58	59	52	52	58	56
1998	55	59	60	53	53	59	57
1999	56	60	62	54	55	60	59
2000	58	62	63	56	56	62	60
2001	59	64	65	57	58	64	62
2002	61	65	67	59	59	65	64
2003	62	67	68	60	61	66	65
2004	63	68	69	61	61	67	66
2005	64	68	70	61	62	68	66
2006	64	69	70	62	63	69	67
2007	64	69	71	62	63	69	67
2008	65	70	71	62	63	69	68
2009	65	70	71	62	63	69	68
2010	64	69	71	62	63	69	67

APPENDIX C

APTITUDE COMPOSITE ABBREVIATIONS

Throughout this report, abbreviations have been used for the titles of the aptitude composites used by the Services. Those abbreviations and their definitions appear in Exhibit C-1.

NVGB - Navy General (Basic)
NVGE - Navy General (Electronic)
MCGT - Marine Corps General Technical
AFG - Air Force General
ARCL - Army Clerical
NVCL - Navy Administrative
MCCL - Marine Corps Clerical
AFCL - Air Force Administrative
AREL - Army Electronics
NVEL - Navy Electronics
MCEL - Marine Corps Electronics
AFEL - Air Force Electronics
ARGM - Army General Maintenance
ARST - Army Skilled Technical
NVST - Navy Skilled Technical
MCFA - Marine Corps Field Artillery
NVNC - Navy Nuclear
AFME - Air Force Mechanical
NVMT - Navy Mechanical Technical
ARMM - Army Mechanical Maintenance
MCMM - Marine Corps Mechanical Maintenance
ARFA - Army Field Artillery
ARCO - Army Combat
MCCO - Marine Corps Combat
AROF - Army Operators/Food
ARSC - Army Surveillance/Communications

Exhibit C-1. SERVICE COMPOSITES AND THEIR ABBREVIATIONS

APPENDIX D

MILITARY OCCUPATIONS BY SERVICE AND APTITUDE CLUSTER

ABBREVIATIONS

Aerosp.	Aerospace
AC	Air Conditioning
Acft.	Aircraft
Aircw.	Aircrew
ATC	Air Traffic Controller
Artil.	Artillery
Av.	Aviation
Cl.	Clerk
Const.	Construction
Cntrl.	Control/Controller
Cr.	Crewman/Crewmember
Elec.	Electrician/Electric/ Electricity/Electronic
Eng.	Engineer
Eqmt.	Equipment
FC	Fire Control
Grnd.	Ground
Helo.	Helicopter
Mach.	Machinist
Mtnce.	Maintenance
Mgt.	Management
Mgr.	Manager
Mech.	Mechanic
Msl.	Missile
Oper.	Operator
Rep.	Repair/Repairer
Rpmn.	Repairman
Sp.	Specialist
Supl.	Supply
Sup.	Support
Tech.	Technician
Trng.	Training

Aptitude Cluster: General
Cluster Factors: Math & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
N/A		6075 Cryogenic Eqmt. Tech.		80
		3061 Subsist. Sup. Mgr.		80
		5831 Corrections Sp.		80
		5811 Military Police		80
		2531 Field Radio Oper.		80
		2111 Small Arms Rpmn.		80
		0400 Bas. Amph. Emb. Mgr.		80
		0161 Postal Oper.		80
		1431 Basic Cartographer		80
		1345 Eng. Eqmt. Oper.		80
		1532 Basic Lithog. Proc.		80
		1521/22 Offset Duplic. Printer		80
		1371 Combat Engineer		80
		2171 FC Instr. Rpmn.		85
		6000 Machinist's Mate		85
		6000 Av. Struc. Mech.		85
		6000 Av. Sup. Eqmt. Mech.		85
		6000 Av. Sup. Eqmt. Elec.		85
		6000 Basic Helo. Mtnce.		85
		6000 Turboprop. Mech.		85
		6046 Av. Mtnce. Admin.		85
		7041 Av. Oper. Clerk		85
		3072 Mar. Av. Supl. Mech.		85
			23132 Still Photo. Sp.	87-90
			57130 Fire Protec. Sp.	87-90
			60252 Packaging Sp.	87-90
			61131 Meatcutter	87-90
			62230 Food Serv. Sp.	87-90

Aptitude Cluster: General
Cluster Factors: Math & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
N/A			64531 Mat'l. Facil. Sp.	87-90
			71330 Prntg. Bindg. Sp.	87-90
			71331 Photolithog. Sp.	87-90
			71332 Duplicating Sp.	87-90
			87130 Instrumentalist	87-90
			87230 Instrum. Tech.	87-90
			92130 Surviv. Trng. Sp.	87-90
			92230 Aircw. Life Sup. Sp.	87-90
	MS Mess Mgt. Sp.	6821 Aerographer Mate		90
		6060 Aircw. Survival		90
		7234 Air Control Elec. Oper.		90
		7242 Air Sup. Elec. Oper.		90
		7200 HAWK Msl. FC Oper.		90
		3500 Adv. Auto Mech.		90
		3311 Basic Baker		90
		3521 Basic Auto Mech.		90
		3371 Basic Food Serv.		90
		3311 Baker		90
		3371 Cook		90
		2311 Ammo. Stor.		90
		0847 Artil. Ball. Meteor.		90
		0151 Administrative Cl.		90
		0842 Field Artillery FC		90
		0231 Intelligence Sp.		90
		4673 Audiovisual Prod. Sp.		90
		4611 Graphics Sp.		90
		4671 Contin. Photoproc. Sp.		90
		1411 Construc. Drafting		90

Aptitude Cluster: General
Cluster Factors: Math & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
		1441 Const. Surveying		90
		1442 Geodetic Surveying		90
N/A	AB Av. Boatsman's Mate			91
			23230 Motion Pic. Cam. Sp.	91-94
			42732 Nondestruc. Insp. Sp.	91-94
			81130 Security Sp.	91-94
			81132 Law Enforcement Sp.	91-94
		6500 Av. Ordinance		95
		5929 HAWK Lnch & Mech. Sys. Rep.		95
		2651 Crypt. Tech. O		95
	CTR Crypt. Tech. (Collection)			97
	CTT Crypt. Tech. (Technical)			97
	DT Dental Tech.			97
	SH Ship's Serviceman			97
		6300 Base Elec. & Elec.		100
		6300 Tech. Skill Bonus Prog.		100
		7311 ATC		100
		7381 Airborne Radio Oper.		100
		5900 Msl. Sys. Mtnce.		100
		5400/6300 Basic Elec. & Elec.		100

Aptitude Cluster: General
Cluster Factors: Math & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
		2621 Crypt. Tech. R		100
		2631 Crypt. Tech. T		100
		2600 Defense Lang. Inst.		100
		4641 Still Photo. Sp.		100
			11130 Def. Aerial Gunner	100-101
			11230 Inflight Refulg. Oper.	100-101
			11530 Pararescue Recov. Sp.	100-101
			20130 Intel. Oper. Sp.	100-101
			22230 Geodetic Surveying	100-101
			23130 Audiovisual Media Sp.	100-101
			23131 Graphics Sp.	100-101
			23330 Contin. Photo. Proc. Sp.	100-101
			27230 ATC Oper.	100-101
			27430 Cmd. & Cntrl. Sp.	100-101
			27530 Tac. Air Cmd. & Cntrl. Sp.	100-101
			27630 Aerosp. Cntrl. Wrng. Sys. Oper.	100-101
			29130 Telecom. Oper. Sp.	100-101
			39130 Mtnce. Anal. Sp.	100-101
			51130 Computer Oper.	100-101
			51131 Programming Sp.	100-101
			56630 Entomologist	100-101
			62231 Diet Therapy Sp.	100-101
			69130 Mgt. Anal. Sp.	100-101

Aptitude Cluster: General
Cluster Factors: Math & Verbal

Army	Navy	Marine Corps	Air Force		Minimum Score
N/A			75130	Educ. Sp.	100-101
			75330	Small Arms Sp.	100-101
			90130	Aeromed. Sp.	100-101
			90230	Med. Serv. Sp.	100-101
			90232	Operating Room Sp.	100-101
			90330	Radiologic Sp.	100-101
			90430	Medical Lab. Sp.	100-101
			90530	Pharmacy Sp.	100-101
			90630	Medical Admin. Sp.	100-101
			90730	Envir. Health Sp.	100-101
			90830	Veterinary Sp.	100-101
			91130	Aerosp. Phys. Sp.	100-101
			91235	Optometry Sp.	100-101
			91330	Physical Therapy Sp.	100-101
			91331	Occ. Therapy Sp.	100-101
			91332	Orthotic Sp.	100-101
			91430	Mental Health Sp.	100-101
			91431	Mental Health Wd. Sp.	100-101
			91530	Med. Material Sp.	100-101
			98130	Dental Asst. Sp.	100-101
			98230	Dental Labs Sp.	100-101
			55330	Site Developer	102-104
	AK Av. Storekeeper				104
	AZ Av. Mtnce. Admin.				104
	BUDS Basic Underwater Demo/Sea Trng.				104
	CTO Crypt. Tech. Comm.				104
	DK Disbursing Cl.				104

Aptitude Cluster: General
Cluster Factors: Math & Verbal

Army	Navy		Marine Corps		Air Force		Minimum Score
N/A	DIVER	Diver (Second Class)					104
	EA	Engineering Aid					104
	IS	Intelligence Sp.					104
	OS	Operations Sp.					104
	PH	Photographer's Mate					104
	SK	Storekeeper					104
	SM	Signalman					104
					20230	Radio Comm. Anal./Sec. Sp.	109-110
					24130	Safety Sp.	109-110
	AG	Aerographer's Mate	7371	Aerial Navigator			110
	DP	Data Proc. Tech.	3421	Pers. Fin. Record Cl.			110
	EOD	Explosive Ordn. Disposal Tech.	3431	Basic Travel Cl.			110
			3451	Fin. Acctg. Cl.			110
	PC	Postal Cl.	3043	Basic Supl. Stk. Cntrl.			110
	PN	Personnelman	2800	Basic Electronics			110
			4063	IBM Sys. 360 OS			110
			4313	Info. Sp. (Brdcst.)			110
			4321	Info. Sp. (Journ.)			110
			4421	Legal Serv. Mgr.			110
			4034	IBM Sys. 36C OS			110
					20530	Elec. Intel. Oper. Sp.	111-113
					20630	Imagery Interp. Sp.	111-113
					20631	Target Intel. Sp.	111-113
					25130	Weather Sp.	111-113
					79130	Information Sp.	111-113
					79131	Radio & TV Brdcst. Sp.	111-113

Aptitude Cluster: General
Cluster Factors: Math & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
N/A	HM Hospital Corpsman			115+(MK+PC+WK+GS)=144
	IC Interior Comm. Tech.			(AR+GS+2MK)=200
	TMT Torpedoman's Mate (Tech.)			(AR+GS+MK)=200
	AE Av. Elec. Mate			(AR+GS+MK)=200
	AW Av. ASW Oper.			(AR+GS+MK)=200
	CE Const. Elec.			(AR+GS+MK)=200
	AC ATC			(AR+GS+MK)=200
			208XX Voice Proc. Sp.	111-113 or Admin. 169-171 & Gen. 100-101
			63130 Fuel Sp.	87-90 & Mech. 173-182
			74230 Club Mgt. Sp.	100-101 & Admin. 169-171

Aptitude Cluster: Administrative/Clerical
Cluster Factors: Speed & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
		3111 Freight & Operators Cl.		80
		3052 Basic Pack. & Pres. Mgr.		80
		3513 Metal Body Rpmn.		80
		2131 Artillery Rpmn.		80
76X Subsistence Supl. Sp.				85
76P Material Cntrl. & Acctg. Sp.		0441 Log. Oper. Cl.		90
		3051 Workshop Cl.		90
76V Material Storage & Handling Sp.		3121 Flight Transpor. Cl.		90
		3141 Passenger Transpor. Cl.		90
76W Petroleum Supl. Sp.		4131 Marine Corps Exch. Mgr.		90
		0161 Postal Oper.		90
		3061 Subsistence Supl. Mgr.		90
71C Stenographer				95
71G Patient Admin. Sp.				95
71L Administrative Sp.				95
71M Chapel Act. Sp.				95
71N Traffic Mgt. Coord.				95
73C Finance Sp.				95
74B Card & Tape Writer				95
75B Personnel Admin. Sp.				95
75C Personnel Mgt. Sp.				95
75D Personnel Rec. Sp.				95
75E Personnel Actions Sp.				95

Aptitude Cluster: Administrative/Clerical
Cluster Factors: Speed & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
76C Ed. Rec. & Pts. Sp.				95
76J Medical Supl. Sp.				95
76Y Unit Supl. Sp.				95
		6046 Av. Mtnce. Admin.		100
		3072 Marine Av. Supl. Mech.		100
		7041 Av. Oper. Cl.		100
		0151 Administrative Cl.		100
		3431 Basic Travel Cl.		100
		4421 Legal Services Mgr.		100
		4621 Av. Oper. Sp.		100
75E Personnel Action Sp.				105
71D Legal Clerk		3081 Purch. Cntrctg. Sp.		110
		2542 Comm. Center Mgr.		110
		3421 Pers. Fin. Rec. Cl.		110
		3043 Bas, Supl. Stk. Cntrl. Mgr.		110
			27131 Airfield Management Sp.	142-146
			27132 Oper. Sys. Mgt. Sp.	142-146
			29333 Ground Radio Oper.	142-146
			60230 Pass. & Hshld. Goods Sp.	142-146
			60231 Freight Traffic Sp.	142-146
			61130 Services Sp.	142-146

Aptitude Cluster: Administrative/Clerical
Cluster Factors: Speed & Verbal

Army	Navy	Marine Corps	Air Force	Minimum Score
			70230 Administration Sp.	142-146
			74131 Recreation Services Sp.	142-146
			60530 Air Passenger Sp.	147-149
	RM Radioman (Basic)			149
			20731 Morse Systems Oper.	156-159
			20732 Printer Systems Oper.	156-159
			55430 Real Estate - Cost Mgt. Anal. Sp.	156-159
			64530 Inventory Mgt. Sp.	156-159
			70130 Chapel Mgt. Sp.	156-159
			73230 Personnel Sp.	156-159
			73231 Personnel Affairs Sp.	156-159
			65130 Contracting Sp.	163-165
	CTA Crypt. Tech. Admin.			165
	JO Journalist			165
	RP Religious Prog. Sp.			165
	YN Yeoman			165
			67231 General Accounting Sp.	169-171
			67232 Disbursement Acctg. Sp.	169-171
	CT1 Crypt. Tech. Interp.			207

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
43M Fabric Repair Sp.				80
57E Laundry & Bath Sp.				80
41J Office Machine Rpmn.				85
41K Reprod. Eqmt. Rep. Sp.				85
43E Parachute Rigger				85
44B Metal Worker				85
45B Small Arms Rep.				85
51B Carpentry & Masonry Sp.				85
51C Structures Sp.				85
51K Plumber				85
51M Firefighter				85
51N Water Trmt. & Plumbing Sys. Sp.				85
55B Ammunition Sp.				85
57F Graves Reg. Sp.				85
57H Terminal Oper. Coor.				85
61F Marine Hull Rep.				85
62E Hvy. Const. Eqmt. Oper.				85
62F Lifting/Loading Eqmt. Oper.				85
62H Conc. & Asphalt Eqmt. Oper.				85
62J Gen. Const. Eqmt. Oper.				85
17K Grnd. Surv. Radar Cr.				85

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army		Navy	Marine Corps		Air Force	Minimum Score
17M	Remote Sensor					85
25J	Operations Central Rep.					85
26D	CCA Radar Rep.					85
41G	Surv. Photo. Eqmt. Rep.					85
03C	Phys. Act. Sp.					85
81C	Cartographer					85
83E	Photo & Layout Sp.					85
83F	Photolithographer					85
84C	Motion Picture Sp.					85
95C	Correctional Sp.					85
41C	FC Instrument Rpmn. ITV/IFV/CFV		7212	REDEYE Gunner		90
			1833	Assault Amphib. Cr.		90
45T	Turrett Mech.		0861	Shore FC Party		90
53B	Industrial Gas Prod. Sp.		0861	Marine Artil. Sct. Observ.		90
62G	Quarrying Sp.		0811	Field Artil. Batteryman		90
68M	Acft. Weapons Sys. Rep.		1833	Amtrac Crew		90
35B	Elec. Instr. Rep.		1811	Tank Crewman		90
36C	Wire Sys. Install. Oper.		2512	Field Wireman		90
			1141	Elec. Eqmt. Rep.		90
36D	Antenna Install. Sp.		2531	Field Radio Oper.		90
36E	Cable Splicer					90
36K	Tac. Wire Oper. Sp.					90
54E	NBC Sp.					90

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
	TM Torpedoman's Mate			91
	MM Machinist's Mate*			94
	EN Engineman			94
41B Topo. Inst. Rep. Sp.				95
42C Orthotic Sp.				95
42D Dental Lab. Sp.				95
42E Optical Lab Sp.				95
44E Machinist				95
45D Special Fld. Artil. Tur. Mech.				95
45G FC Sys. Rep.				95
45K Tank Turret Rep.				95
45L Atillery Rep.				95
45R Msl. Tank Tur. Mech.				95
51G Materials Qlty. Sp.				95
51R Interior Elec.				95
52C Utility Eqmt. Rep.				95
52D Power Generator Eqmt. Rep.				95
54C Smoke Oper. Sp.				95
55G Nuc. Weap. Mtnce. Sp.				95
68J Acft. FC Rep.				95
21G PERSHING Elec. Mtnce. Sp.				95

* The nuclear qualification is composed of combined qualifications corresponding to these ratings.

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
21L PERSHING Elec. Rep.				95
22L NIKE Test Eqmt. Rep.				95
22N NIKE-HERC. Missile Launch Rep.				95
23N NIKE Tracking Radar Rep.				95
23U NIKE HP Radar Simulation Rep.				95
24H IH FC Rep.				95
24K IH CW Radar Rep.				95
24L IH Lnch./Mech. Sys. Rep.				95
25L AN/TSQ-73 Oper. Rep.				95
26B Weapons Support Radar Rep.				95
26C Combat Area Surv. Radar Rep.				95
26H Air Defense Radar Rep.				95
26M Aerial Surv. Radar Rep.				95
26N Aerial Surv. Infantry Rep.				95
26Q Tac. Sat./M-Wave Sys. Oper.				95
26R Strat. Sat./M-Wave Sys. Oper.				95

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
26T Radio/TV Sys. Sp.				95
26V Strat. M-Wave Sys. Rep.				95
26B LCSS Test Sp./ LANCE Rep.				95
27E TOW/DRAGON Rep.				95
27F VULCAN Rep.				95
27G CHAPARRAL/REDEYE Rep.				95
27H SHILLALAGH Rep.				95
27N FAAR Rep.				95
31M Mech. Comm. Eqmt. Oper.				95
31N Tactical Cir. Con.				95
31V Tac Comm. Sys. Oper./Mech.				95
32D Station Tech. Cntrl.				95
32H Fixed Station Radio Rep.				95
34B PCM Rep.				95
34G FC Computer Rpmn.				95
34Y Field Artil. Computer Rep.				95
35E Support Elec. Devices Rep.				95
35F Nuc. Weap. Elec. Sp. Elec. Sp.				95
35K Avionic Mechanic				95
41E Av. Eqmt. Rep.				95

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
45G PC Sys. Rep.				95
46N PERSHING Elec. Mech. Rep.				95
52G Trans. & Distr. Sp.				95
93F Field Artil. Meteor. Cr.				95
93E Meteor. Obsv.				95
96B Intelligence Anal.				95
96C Interrogator				95
96D Image Interpreter				95
84F Audio/TV Sp.				95
91B Medical Sp.				95
91C Patient Care Sp.				95
91D Operating Room Sp.				95
91E Dental Sp.				95
91F Psychiatric Sp.				95
91H Orthopedic Sp.				95
91J Phys. Thpy. Sp.				95
91L Occ. Thpy. Sp.				95
91N Cardiac Sp.				95
91Q Pharmacy Sp.				95
91S Envir. Health. Sp.				95
91T Animal Care Sp.				95
91U ENT Sp.				95
91W Respiratory Sp.				95
91Y Eye Sp.				95
92B Medical Lab Sp.				95

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army		Navy	Marine Corps		Air Force	Minimum Score
92C	Petroleum Lab Sp.					95
92D	Chemical Lab Sp.					95
05D	EW/SIGINT Ident/ Loc.					95
05H	EW/SIGINT Intcp. IMC					95
05K	EW/SIGINT N-M Intcp.					95
13C	TACFIRE Oper. Sup.					95
13E	Cannon Fire Direction Sp.					95
71P	Flt. Oper. Coord.					95
81B	Tech. Draft Sup.					95
81E	Illustrator					95
82B	Construction Surveyor					95
82C	Field Artil. Survey					95
82D	Topo. Survey					95
84B	Still Photo. Sup.					95
55D	EOD Sp.		0842	Field Artil. Radar		100
26L	Tac. M-Wave Sys. Rep.		0847	Artil. Ball. Meteor.		100
26Y	SATCOM Grnd. Sta. Rep.		5929	HAWK Lnch. & Sys. Rep. Mech.		100
32G	Fixed Crypt. Eqpt. Rep.		1142	Elec. Eqpt. Oper.		100
			6300	Basic Elec. & Elec.		100

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army		Navy	Marine Corps	Air Force	Minimum Score
35L	Avionic Comm. Eqmt. Rep.				100
35M	Avionic Nav./Flt. Cntrl. Eqmt. Rep.				100
35R	Avionic Special Eqmt. Rep.				100
36H	Tac Wire Oper. Sp.				100
74D	Computer/Machine Oper.				100
74F	Programmer/Analyst				100
91P	X-Ray Sp.				100
91R	Veterinary Sp.				100
93H	ATC Tower Op.				100
93J	ATC Radar Cntrl.				100
95B	Military Police				100
71Q	Journalist				105
71R	Brdcst. Journ.				105
73D	Acctg. Sp.				105
91G	Behav. Sci. Sp.				105
97B	Counter. Intel. Agent				105
98C	EW/SIGINT Analyst				105
98J	EW/SIGINT NC Intercp.				105

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
		0842 Field Artil. FC		110
	BT Boiler Tech.	5929 HAWK Lnch. Mech. Sys. Rep.		110
		5900 Msl. Sys. Mtnce. Func.		110
		5900/6300 Basic Elec. & Elec.		110
		6300 Tech. Skills Bonus Program		110
31S Field General COMSEC Rep.	NN Navy Nuclear*	2[illegible]00 Basic Elec.		115
35H Calibration Sp.				120
	[illegible]MS Torpedoman's Mate (Sub)			146
	STS Sonar Tech. (Submarine)			146
	HT Hull Mtnce. Tech.			162
			42330 Acft. Elec. Sys. Sp.	181-186
			54230 Electrician	181-186
			54231 Elec. Pwr. Line Sp.	181-186
	[illegible]M Av. Mach. Mate			190
	AD Av. Ordnanceman			190

* The nuclear qualification is composed of combined qualifications corresponding to these ratings.

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
			36231 Telephone Sw. Eqmt. Sp. Elec./Mech.	191-194
			36232 Elec. Sys. Sw. Sp.	191-194
			36233 Msl. Cntrl. Comm. Sys. Sp.	191-194
			36234 Tele. Eqmt. Install. & Rep. Sp.	191-194
			40430 Precis. Imag. & Audiovisual Media Mtnce. Sp.	191-194
			40431 Aero. Photo. Sys. Sp.	191-194
			46330 Nuc. Weap. Sp.	191-194
	EM Electricians Mate*			200
	IC Interior Comm.*			200
	GM Gunner's Mate			204
	TD Traderman			212
	AQ Av. FC Tech.			212
	AT Av. Elec. Tech.			212
	AV Avionics Group			212
	AX Av. ASW Tech.			212
	GS Gas Turb. Sys. Mech.			218
	RM Radioman			218
	UFT Underwater FC Tech.			218
	AQ Av. FC Tech.			218
	AT Av. Elec. Tech.			218

* The nuclear qualification is composed of combined qualifications corresponding to these ratings.

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
	AX Av. ASW Tech.			218
	CTM Cryptologic Tech.-Mtnce.			218
	DS Data Systems Tech.			218
	ET Electronics Tech.*			218
	EW Elec. Warfare Tech.			218
	FTG-FTM FC Tech.			218
	SW-SE Strat. Weap. Sys. Elec.			218
	STG Sonar Tech. (Surf.)			218
	STS Sonar Tech. (Sub.)			218
			30230 Weath. Eqmt. Sp.	218-223
			30231 Airborne Meteor./Atm. Res. Eqmt. Sp.	218-223
			30331 ATC Radar Sp.	218-223
			30332 Acft. Cntrl. & Warn. Radar Sp.	218-223
			30333 Auto. Track Radar Sp.	218-223
			30430 Radio Relay Eqmt. Sp.	218-223
			30431 Nav. Aids Eqmt. Sp.	218-223
			30434 Grnd. Radio Comm. Eqmt. Sp.	218-223
			30435 TV Eqmt. Sp.	218-223
			30436 Space Comm. Sys. Eqmt./Oper./Sp.	218-223
			30534 Elec. Computer Sys. Sp.	218-223

* The nuclear qualification is composed of combined qualifications corresponding to these ratings.

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force		Minimum Score
			30630	Elec. Comm. & Crypt. Eqmt. Sys. Sp.	218-223
			30631	Elec. Mech. Comm. Crypt. Eqmt. Sys. Sp.	218-223
			30632	Telecomm. Sys. Mtnce. Sp.	218-223
			30730	Telecomm. Sys. Cntrl. Sp./Att.	218-223
			30830	Space Sys. Eqmt. Sp.	218-223
			30930	Msl. Warn. & Space Surv. Sensor Rep. Sp.	218-223
			31630	Msl. Sys. Analyst Sp.	218-223
			31631	Msl. Sys. Mtnce Sp.	218-223
			31632	Msl. Elec. Eqmt. Sp.	218-223
			31633	Instrumentation Mech.	218-223
			32130	Bomb-Nav. Sysm. Mech.	218-223
			32131	Def. FC Sys. Mech.	218-223
			32132	Weap. Cntrl. Sys. Mech.	218-223
			32232	Av. Sensor Sys. Sp.	218-223
			32430	Precision Meas. Eqmt. Sp.	218-223
			32530	Auto. Flt. Cntrl. Sys. Sp.	218-223
			32531	Avionic Inst. Sys. Sp.	218-223
			32630	Avionic Aerosp. Grnd. Eqmt. Sp.	218-223
			32631	Integ. Avionic Comp. Sp.	218-223
			32632	Integ. Avionic Sys. Sp.	218-223
			32633	Integ. Avionic Elect. Warf. Eqmt. & Comp. Sp.	218-223
			32634	Integ. Avionic Computer Test Sta. & Comp. Sp.	218-223

Aptitude Cluster: Technical
Cluster Factors: Math & Verbal & Technical

Army	Navy	Marine Corps	Air Force		Minimum Score
			32635	Integ. Avionic Man. Test Sta. & Comp. Sp.	218-223
			32636	Integ. Avionic Attack Cntrl. Sys. Sp.	218-223
			32637	Integ. Avionic Inst. Flight Cntrl. Sys. Sp.	218-223
			32638	Integ. Avionic Comm. Nav. & Pen. Aid Sys. Sp.	218-223
			32830	Avionic Comm. Sp.	218-223
			32831	Avionic Nav. Sys. Sp.	218-223
			32832	Air Warn. & Cntrl. Radar Sp.	218-223
			32833	Elec. Warf. Sys. Sp.	218-223
			32834	Avionic Inertial Radar Nav. Sys. Sp.	218-223
			34131	Instr. Trainer Sp.	218-223
			34132	Def. Sys. Trainer Sp.	218-223
			34133	Analog Flt. Sim. Sp.	218-223
			34134	Digital Flt. Sim. Sp.	218-223
			34135	Analog Nav/Tac. Train. Dev. Sp.	218-223
			34137	Msl Trng. Sp.	218-223

Aptitude Cluster: Mechanical
Cluster Factors: Verbal & Technical

Army	Navy		Marine Corps	Air Force		Minimum Score
N/A	AM	Av. Structural Mech.	N/A			94
	BU	Builder				145
	CM	Const. Mech.				145
	SW	Steelworker				145
	UT	Utilitiesman				145
	AS	Av. Sup. Eqmt. Tech.				153
	GMT	Gunner's Mate Tech. (Bomb)				153
	HT	Hull Mtnce. Tech. (Basic)				153
	ML	Molder				153
	MN	Minesman				153
	MR	Machinery Rpmn.				153
	PM	Patternmaker				153
	PR	Acft. Survival Eqmt.				153
	IM	Instrumentman				162
	OM	Opticalman				162
				36130	Cable & Ant. Install. & Mtnce. Sp.	173-182
				36131	Cable Splcg. Install. & Mtnce. Sp.	173-182
				42331	Acft. Envir. Sys. Mech.	173-182
				42334	Acft. Pneudraulic Sys. Mech.	173-182

Aptitude Cluster: Mechanical
Cluster Factors: Verbal & Technical

Army	Navy	Marine Corps	Air Force		Minimum Score
N/A		N/A	42631	Recip. Propulsion Mech.	173-182
			42632	Jet Engine Mech.	173-182
			42633	Turboprop. Propulsion Mech.	173-182
			42733	Fabric. & Parachute Sp.	173-182
			42734	Metals Processing Sp.	173-182
			42735	Airframe Rep. Sp.	173-182
			47230	Base Vehicle Eqmt. Mech.	173-182
			47231	Special Veh. Mech.	173-182
			47332	Gen. Purpose Veh. Mech.	173-182
			47233	Veh. Body Mech.	173-182
			53130	Machinist	173-182
			54730	Heating Sys. Sp.	173-182
			55130	Pavement Mtnce. Sp.	173-182
			55131	Const. Eqmt. Oper.	173-182
			55230	Carpentry Sp.	173-182
			55231	Masonry Sp.	173-182
			55232	Metal Fabric. Sp.	173-182
			55234	Protective Coating Sp.	173-182
			55235	Plumbing Sp.	173-182
			56631	Envir. Support Sp.	173-182
			59130	Seaman	173-182
			59131	Marine Engine Sp.	173-182
			60330	Vehicle Oper./Dispatcher	173-182
			42335	Aerosp. Grnd. Eqmt. Mech.	174-180
			11430	Acft. Loadmstr.	190-195
			42332	Aircrew Egress Sys. Mech.	190-195
			42731	Corrosion Control Sp.	190-195
			43130	Helicopter Mech.	190-195

Aptitude Cluster: Mechanical
Cluster Factors: Verbal & Technical

Army	Navy	Marine Corps	Air Force		Minimum Score
N/A		N/A	43131	Tactical Acft. Mtnce. Sp.	190-195
			43132	Airlift/Bomb Acft. Mtnce. Sp.	190-195
			44330	Missile Mtnce. Sp.	190-195
			44331	Msl. Pneudaulic Rpmn.	190-195
			54232	Elec. Pwr. Prod. Sp.	190-195
			54430	Cryogenic Fluids Prod. Sp.	190-195
			54530	Refrig. & AC Sp.	190-195
			54630	Liq. Fuel Sys. Mtnce. Sp.	190-195
			60531	Air. Cargo Sp.	190-195
			46130	Munitions Sys. Sp.	201-206
			46230	Acft. Armamt. Sys. Sp.	201-206
			46430	Explov. Ord. Displ. Sp.	201-206
			42335	Aerosp. Grnd. Eqmt. Mech.	173-182 & AR+GS+MK+EI =174-180

Aptitude Cluster: Mechanical Maintenance
Cluster Factors: Math & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
	N/A	3531 Hvy. Veh. Oper.	N/A	80
		3535 Lt. Veh. Oper.		80
		1181 Fabric. Rpmn.		80
		1171 Laundry & Bath Sp.		80
		1381 Shore Party Sp.		80
		1391 Bulk Fuel Sp.		80
12C Bridge Crewman				85
61B Watercraft Oper.				85
62B Const. Eqmt. Rep.				85
63B Lt. Wt. Veh. & Pwr. Gen. Mech.				85
63H Track Veh. Rep.				85
63J QM & Chem. Eqmt. Rep.				85
63W Wheel Veh. Rep.				85
		1173 QM Eqmt. Rep.		90
		1341 Basic Eng. Eqmt. Mech.		90
		7051 Av. Crash Crew		90
		7011 Acft. Lnch. & Recov. Eqmt.		90
		3521 Basic Auto. Mech.		90
		2131 Artillery Rep.		90
		3513 Metal Body Rep.		90
		1371 Basic Combat Eng.		90
		1345 Eng. Eqmt. Oper.		90
		2111 Small Arms Rep.		90
		1316 Basic Metal Wkr.		90
		1182 Office Mach. Rep.		90

Aptitude Cluster: Mechanical Maintenance
Cluster Factors: Math & Technical

Army		Navy	Marine Corps		Air Force	Minimum Score
		N/A	1121	Basic Plumbing & Water Supply Mtnce.	N/A	90
			1371	Combat Engineer		90
33S	EW/Intercept Sys. Rep.					95
45E	M1 Abrams Tank Turret Mech.					95
45N	M60A1/A3 Tank Turret Mech.					95
63E	M1 Abrams Tank Sys. Mech.					95
63N	M60A1/A3 Tank Sys. Mech.					95
61C	Watercraft Engineer		2142	Assault Amphib. Rep.		100
63D	SPFA Sys. Mech.		2144	Tracked Veh. Rep. Artil.		100
63G	Fuel & Elec. Sys. Rep.		2145	Tank Veh. Rep. Tank		100
			3500	Adv. Auto. Mech.		100
63S	Hvy. Wheel Veh. Mech.		6000	Machinist's Mate		100
			6000	Av. Struct. Mech.		100
63T	ITV/IFV/CFV Sys. Mech.		6000	Av. Sup. Eqmt. Elec.		100
			6000	Av. Sup. Eqmt. Mech.		100
63Y	Track Veh. Mech.		6000	Basic Helo. Mtnce.		100
67G	Airplane Rep.		6075	Cryogenic Eqmt. Tech.		100
67H	Obsn. Airplane Rep.		6060	Aircrew Surv. Eqmt.		100
67N	Utility Helo. Rep.		6000	Turboprop. Mech.		100
67T	Tac Trans. Helo. Rep.		6000	Av. Support Eqmt. Tech. (Elec.)		100
67U	Medium Helo. Rep.		2171	FC Instr. Rep.		100
67V	Obsn/Scout Helo. Rep.		1161	Basic Refrig. Mech.		100
			2161	Machinist		100
67Y	Attack Helo. Rep.					100

Aptitude Cluster: Mechanical Maintenance
Cluster Factors: Math & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
68B Acft. Powerplant Rep.				100
68D Acft. Powertrain Rep.				100
68F Acft. Electrician				100
68G Acft. Struc. Rep.				100
68H Acft. Pneudraulics Rep.				100

Aptitude Cluster: Combat
Cluster Factors: Math & Speed & Technical

Army		Navy	Marine Corps	Air Force	Minimum Score
13B	Cannon Crewman	N/A	N/A	N/A	85
11B	Infantryman				85
11C	Indirect Fire Infantryman				85
11H	HV Antiarmor Weap. Cr.				85
11M	FV Infantryman				85
12B	Combat Engineer				85
12F	Engine & Tr. Veh. Cr.				85
19D	Cavalry Scout				85
19E	M48-M60 Armor Cr.				85
19F	Tank Driver				85
19K	M1 Abrams Armor Cr.				85
12E	ADM Sp.				95
13F	Fire Support Sp.				100
15J	MLRS/LANCE OP/FD Sp.				100

Aptitude Cluster: Field
Cluster Factors: Speed & Verbal & Technical

Army	Navy	Marine Corps	Air Force	Minimum Score
	N/A	0300 Infantry Trng. 0311 Infantry Trng.	N/A	80 80
16B HERCULES Msl. Cr.				85
16D HAWK Missile Cr.				85
16F Light AD Artil. Cr.				85
16P AD Artil. Short Rg. Msl. Cr.				85
16R AD Artil. Short Rg. Gunnery Cr.				85
16S MANPADS Crewman				85
64C Motor Transport Oper.				85
94B Food Service Sp.				85
05B Radio Operator		0300 Marine Barracks		90
72E Cmbt. Telecom. Cen. Oper.		0300 Sea Duty		90 90
72G Auto. Data Telecom. Cen. Oper.				90
15D LANCE Cr./MLRS Sgt.				95
15E PERSHING Msl. Cr.				95
16C HERCULES FC Cr.				95
16E HAWK FC Cr.				95
16J Def. Acq. Radar Oper.				95

Aptitude Cluster: Field
Cluster Factors: Speed & Verbal & Technical

Army		Navy	Marine Corps	Air Force	Minimum Score
94F	Hosp. Food Services Sp.	N/A		N/A	95
05C	Radio Teletype Oper.				95
05G	SIGSEC Sp.				95
17C	Field Artil. Tgt. Acq. Sp.				95
17L	Aerial Sensor Sp.				95
96H	Aerial Sensor Specialist (OV-ID)				95
13M	MLRS Crewmember				100
13R	Firefinder Radar Oper.				100
17B	Field Artil. Radar Cr.				100

APPENDIX E

CENSUS DIVISION DEFINITIONS

CENSUS DIVISION DEFINITIONS

This section presents a brief outline of the characteristics contributing to the development of U.S. Census regions and divisions.

The concept of regions and divisions was first formulated in 1880, with a substantial redefinition occurring in 1910. The primary reasons for grouping the states into the geographic regions and divisions include:

- Colonial Settlement,
- Topographic Similarity,
- Climatic Conditions,
- Industrial Development,
- Percentage of Foreign Born Population,
- Percentage of Negro Population,
- Type of Agriculture, and
- Urban-Rural Characteristics.

Despite being designated over 100 years ago, these reasons still form the basis for Census classifications. Although some modifications have occurred, they have not been of a substantial magnitude to warrant a redefinition of the Census regions and divisions. Exhibit D-1 lists the current census classification of states by region and division.

TABLE D-1

U.S. BUREAU OF CENSUS CLASSIFICATION OF STATES
BY REGION AND DIVISION

Region	Division and States	
NORTHEAST	New England	Middle Atlantic
	Maine	New York
	New Hampshire	New Jersey
	Vermont	Pennsylvania
	Massachusetts	
	Rhode Island	
	Connecticut	
NORTH CENTRAL	East North Central	West North Central
	Ohio	Minnesota
	Indiana	Iowa
	Illinois	Missouri
	Michigan	North Dakota
	Wisconsin	South Dakota
		Nebraska
		Kansas
SOUTH	South Atlantic	East South Central
	Delaware	Kentucky
	Maryland	Tennessee
	District of Columbia	Alabama
	Virginia	Mississippi
	West Virginia	West South Central
	North Carolina	
	South Carolina	Arkansas
	Georgia	Louisiana
	Florida	Oklahoma
		Texas
WEST	Mountains	Pacific
	Montana	Washington
	Idaho	Oregon
	Wyoming	California
	Colorado	Alaska
	New Mexico	Hawaii
	Arizona	
	Utah	
	Nevada	

TABLE D-1 (CONTINUED)

U.S. BUREAU OF CENSUS CLASSIFICATION OF STATES
BY REGION AND DIVISION

Region	Division and States
OTHER	Outlying Areas, Bordering Nations; and Countries, Dependencies, and Areas of Special Sovereignty

Mexico
American Samoa
Canal Zone
Caroline Islands
Cook Islands
Gilbert and Ellice Islands
Mariana Islands
Marshall Islands
Puerto Rico
Trust Territories of the Pacific Islands
U.S. Miscellaneous Pacific Islands
Virgin Islands
Wake Island

APPENDIX F

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